

**EPA Superfund  
Record of Decision:**

**STAUFFER CHEMICAL CO. (LEMOYNE PLANT)  
EPA ID: ALD008161176  
OU 02  
AXIS, AL  
03/18/1999**



5 9 0001

244103  
Stauffer Chemical  
S.9  
AL 002

---

---

**RECORD OF DECISION**  
**SUMMARY OF REMEDIAL ALTERNATIVE SELECTION**

**STAUFFER CHEMICAL CO. (LEMOYNE PLANT) SITE**  
**OPERABLE UNIT TWO**  
**AXIS, MOBILE COUNTY, ALABAMA**

**PREPARED BY**  
**U. S. ENVIRONMENTAL PROTECTION AGENCY**  
**REGION 4**  
**ATLANTA, GEORGIA**

---

---

## TABLE OF CONTENTS

1.0	<u>SITE LOCATION AND DESCRIPTION</u>	1
2.0	<u>SITE HISTORY AND ENFORCEMENT ACTIVITIES</u>	1
3.0	<u>HIGHLIGHTS OF COMMUNITY PARTICIPATION</u>	5
4.0	<u>SCOPE AND ROLE OF OPERABLE UNIT</u>	6
5.0	<u>SUMMARY OF SITE CHARACTERISTICS</u>	7
5.1	<u>GEOLOGY/SOILS</u>	7
5.2	<u>SURFACE WATER</u>	8
5.3	<u>HYDROGEOLOGY</u>	8
5.4	<u>NATURE AND EXTENT OF CONTAMINATION</u>	8
5.5	<u>CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES</u>	13
6.0	<u>SUMMARY OF OPERABLE UNIT TWO RISKS</u>	14
6.1	<u>CONTAMINANTS OF CONCERN</u>	14
6.2	<u>EXPOSURE ASSESSMENT</u>	14
6.3	<u>TOXICITY ASSESSMENT</u>	19
6.4	<u>RISK CHARACTERIZATION</u>	21
6.5	<u>ECOLOGICAL RISK</u>	24
6.6	<u>REMEDIATION OBJECTIVES</u>	25
7.0	<u>DESCRIPTION OF ALTERNATIVES</u>	28
7.1	<u>ALTERNATIVE NO. 0 - NO ACTION</u>	28
7.2	<u>ALTERNATIVE NO. 1 - INSTITUTIONAL CONTROLS</u>	28
7.3	<u>ALTERNATIVE NO. 2 - MULTI-LAYER CAP</u>	29
7.4	<u>ALTERNATIVE NO. 3 - EXCAVATION AND OFFSITE DISPOSAL</u>	29
7.5	<u>ALTERNATIVE NO. 4 - EXCAVATION AND EX-SITU ONSITE BIOREMEDIATION</u>	29
7.6	<u>ALTERNATIVE NO. 5 - EXCAVATION AND EX-SITU BIOREMEDIATION/ IN-SITU SOIL FLUSHING</u>	29
7.7	<u>ALTERNATIVE NO. 6 - EXCAVATION AND OFFSITE DISPOSAL/ IN-SITU FLUSHING</u>	30
7.8	<u>ALTERNATIVE NO. 7- IN-SITU SOIL FLUSHING</u>	30
7.9	<u>ALTERNATIVE NO. 8 - ASPHALT CAP</u>	30
8.0	<u>SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES</u>	31
8.1	<u>OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT</u>	32
8.2	<u>COMPLIANCE WITH ARARS</u>	33
8.3	<u>LONG-TERM EFFECTIVENESS AND PERMANENCE</u>	34

8.4	<u>REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT</u>	34
8.5	<u>SHORT-TERM EFFECTIVENESS</u>	34
8.6	<u>IMPLEMENTABILITY</u>	35
8.7	<u>COST</u>	35
8.8	<u>STATE ACCEPTANCE</u>	36
8.9	<u>COMMUNITY ACCEPTANCE</u>	36
9.0	<u>SUMMARY OF SELECTED REMEDY</u>	36
9.1	<u>SOIL REMEDY</u>	36
9.2	<u>PERFORMANCE STANDARDS FOR SOIL</u>	38
10.0	<u>STATUTORY DETERMINATION</u>	40
10.1	<u>PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT</u>	40
10.2	<u>ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)</u>	40
10.3	<u>COST EFFECTIVENESS</u>	41
11.0	<u>DOCUMENTATION OF SIGNIFICANT CHANGES</u>	42

## TABLES

TABLE 5-1 - SUMMARY OF MAXIMUM CARBON TETRACHLORIDE POND SOIL BORING DATA	10
TABLE 5-2 - SUMMARY OF MAXIMUM CARBON DISULFIDE POND SOIL BORING DATA	11
TABLE 5-3 - SUMMARY OF MAXIMUM FORMER HALBY AREA BORING DATA	12
TABLE 5-4 - SUMMARY OF MAXIMUM SURFACE WATER AND SEDIMENT DATA AT THE OLD FIREWATER POND	12
TABLE 5-5 - SUMMARY OF MAXIMUM SURFACE WATER AND SEDIMENT DATA AT THE UNNAMED TRIBUTARY	13
TABLE 6-1 - SUMMARY OF CHEMICALS OF POTENTIAL CONCERN	16
TABLE 6-2 - EXPOSURE CONCENTRATIONS AT HALBY POND AREA	17
TABLE 6-3 - EXPOSURE CONCENTRATION AT CARBON DISULFIDE POND AND OIL CARBON TETRACHLORIDE WWT POND	18
TABLE 6-4 - EXPOSURE CONCENTRATION AT OLD FIREWATER POND AND UNNAMED TRIBUTARY	19
TABLE 6-5 - CANCER SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN	20
TABLE 6-6 - REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN	22
TABLE 6-7 - TOTAL RISKS ASSOCIATED WITH DERMAL CONTACT, INHALATION AND INGESTION	23
TABLE 6-8 - COMPARISON OF OBSERVED CONCENTRATIONS TO WATER QUALITY CRITERIA	25
TABLE 6-9 - PERFORMANCE STANDARDS FOR SUBSURFACE SOILS	26

TABLE 6-10 - STATUS OF ELIMINATED POTENTIAL SOURCE AREAS . . . . .	27
TABLE 9-1 - SUBSURFACE SOIL PERFORMANCE STANDARDS . . . . .	37
TABLE 9-2 - SUMMARY OF SELECTED REMEDY COSTS . . . . .	39
TABLE 10- 1 APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS . . . .	43

## FIGURES

Figure 1 - Area Map . . . . .	2
Figure 2 - Site Map . . . . .	3

## APPENDICES

Appendix 1 - Responsiveness Summary	
Appendix 2 - State Concurrence Letter	

DECLARATION  
of the  
RECORD OF DECISION  
OPERABLE UNIT TWO

SITE NAME LOCATION

Stauffer Chemical Co. (LeMoyne Plant) Site, Operable Unit Two  
Axis, Mobile County, Alabama

STATEMENT OF BASIS AND PURPOSE

This decision document (Record of Decision), presents the selected Remedial Action for Operable Unit Two for the Stauffer Chemical Co.(LeMoyne Plant) Site (“Stauffer LeMoyne Site” or “Site”), Operable Unit Two, Axis, Mobile County, Alabama, developed in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. Section 9601 *et. seq.*, and to the extent practicable, the National Contingency Plan (NCP) 40 CFR Part 300. This decision is based on the administrative record for the Stauffer site.

The State of Alabama, as represented by the Alabama Department of Environmental Management (ADEM), has been the support agency during the Remedial Investigation and Feasibility Study process for the Stauffer LeMoyne Site. In accordance with 40 CFR 300.430, as the support agency, ADEM has provided input during this process. The State of Alabama, as represented by ADEM has concurred with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from the Stauffer LeMoyne Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.

DESCRIPTION OF SELECTED REMEDY

This operable unit is the second of three for the Site. This alternative requires the design and implementation of response measures which will protect human health and the environment. EPA signed a ROD for the first operable unit on September 27, 1989. The first operable unit addressed the groundwater contamination at this Site and the Stauffer Chemical Co. (Cold Creek Plant) Site (“Stauffer Cold Creek Site”). The remedy for the first operable unit is ongoing. The second operable unit addresses the source contamination in the subsurface soil. The ROD for the

second operable unit will be the last ROD for the Stauffer LeMoyne Site. EPA signed a ROD for the third operable unit on September 17, 1993. The third operable unit, which addresses contamination in the Cold Creek Swamp, is in the remedial design phase.

The major components of the selected remedy for operable unit two are:

- Institutional controls to restrict construction on the former Halby area until the subsurface soil performance standards are met and to restrict the Stauffer LeMoyne Site from converting to residential use until such time as EPA determines through a risk assessment that the Site is available for unrestricted use,
- Construction of a soil flushing system in the former Halby area to accelerate the migration of contaminants from the subsurface soil into the groundwater where contaminants will be captured and treated by the existing OU1 groundwater remedy,
- Monitoring of subsurface soil for cyanide and thiocyanate in the former Halby area on an annual basis to ensure that contaminants are moving into the groundwater in a controlled manner where they will be captured and treated by the OUI groundwater remedy, and
- Periodic reporting of annual monitoring results to EPA.

Because a risk assessment for a future residential scenario was not performed for OU2 of the Site, institutional controls restricting the Site from use as residential property must remain in place until a human health risk assessment is conducted which demonstrates to EPA that the Site does not pose any unacceptable risks to future residents. Restriction of construction on the former Halby area is necessary to allow soil flushing to occur in this area. Monitoring of groundwater concentrations will continue under the OU1 remedy. The cost of the OU2 remedy is estimated to be \$501,000.

The selected remedy will address the principal threat waste of thiocyanate in the subsurface soil. Thiocyanate is highly mobile to the groundwater and will continue to move into the groundwater in an uncontrolled manner, if the remedy is not implemented. The selected remedy also addresses the low-level threat of cyanide in the subsurface soil. This remedy will accelerate and monitor the movement of contaminants from the subsurface soil into the groundwater, and will be able to control the movement, if necessary.

This remedy is preferred over the other alternatives considered due to its cost effectiveness and short term effectiveness. This remedy will protect human health and the environment and will meet all applicable or relevant and appropriate regulations, while minimizing the expenditure of resources.

## STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with federal and state requirements that are legally applicable or relevant and appropriate, and is cost-effective. This remedy satisfies the preference for treatment that reduces toxicity, mobility, or volume as a principal element. Treatment is provided by flushing contamination from the subsurface soil. Further treatment is provided by the OU1 groundwater remedy. Finally, it is determined that this remedy utilizes a permanent solution and alternative treatment technology to the maximum extent practicable.

## ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern (COCs) and their respective concentrations
- Baseline risk represented by the COCs
- Cleanup levels established for COCs and the basis for the levels
- Current and future land and groundwater use assumptions used in the baseline risk assessment and ROD
- Land and groundwater use that will be available at the site as a result of the Selected Remedy
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected
- Decisive factors that led to selecting the remedy

This remedy is based on risk assessments for industrial use scenarios. Contamination may be present which would restrict the use of this property for residential use. Because this remedy may result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.



**RICHARD D. GREEN, DIRECTOR  
WASTE MANAGEMENT DIVISION**

**18 MAR 99**

**DATE**

**Decision Summary  
Record of Decision  
Operable Unit Two**

**Stauffer Chemical Co. (LeMoyne Plant) Superfund Site  
Operable Unit Two  
Axis, Mobile County, Alabama**

**1.0 SITE LOCATION AND DESCRIPTION**

The Stauffer Chemical Co. (LeMoyne Plant) Superfund Site (hereinafter, “Stauffer LeMoyne” or “the Site”) is located approximately 20 miles north of Mobile Alabama on U.S. Highway 43. The CERCLIS identification number for the Site is ALD008161176. For an area location map and general Site map, see Figures 1 and 2, respectively. The Site encompasses approximately 730 acres. The Site is an industrial facility bounded by the Stauffer Chemical Co. (Cold Creek Plant) site (“Stauffer Cold Creek”) on the north, Courtaulds North America, another chemical company on the south, the Mobile River on the east, and Highway 43 on the west. The area is predominantly industrial, with a few small rural residential communities within a few miles of the site. The site is currently owned and operated by Akzo Nobel Chemicals, Inc. (Akzo) which manufactures carbon disulfide, sulfuric acid, and a proprietary sulfuric compound at the facility.

**2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES**

The Stauffer LeMoyne site was previously owned by Stauffer Chemical Company (“Stauffer”), which began operations in 1953. In 1987, the facility was purchased by Akzo Chemie America, Inc., now called Akzo Nobel Chemicals, Inc. Wastewaters from the Stauffer LeMoyne processes were held in ponds, some of which discharged to the Cold Creek Swamp. All of these ponds except for one were clay-lined and were closed under the direction of AWIC. Several membrane-lined ponds, which are currently active, were installed during the 1970's to replace those mentioned above. One of these is regulated by a Resource Conservation and Recovery Act (RCRA) permit.

From 1965 to 1979, a small portion of land on the western end of the LeMoyne site was leased by Stauffer to the Halby Chemical Company (HCC), which manufactured dye chemicals. This area is located adjacent to the Norfolk-Southern Railroad line and is approximately 700 feet north of the main entrance to the Stauffer LeMoyne site. Witco, Inc. purchased the HCC facility (the “former Halby area”) in 1974, and continued to operate the plant until 1979. The plant used the following raw materials: carbon disulfide, ammonia, caustic soda, ethylene oxide, methyl acrylate, hydrogen sulfide, and para-toluenesulfonic acid. The plant produced ammonium thiocyanate, sodium thiocyanate, ammonium sulfide, sodium sulfur hydrate, thiodiglycolate, and methyl mercaptopropionic acid as products and by-products.

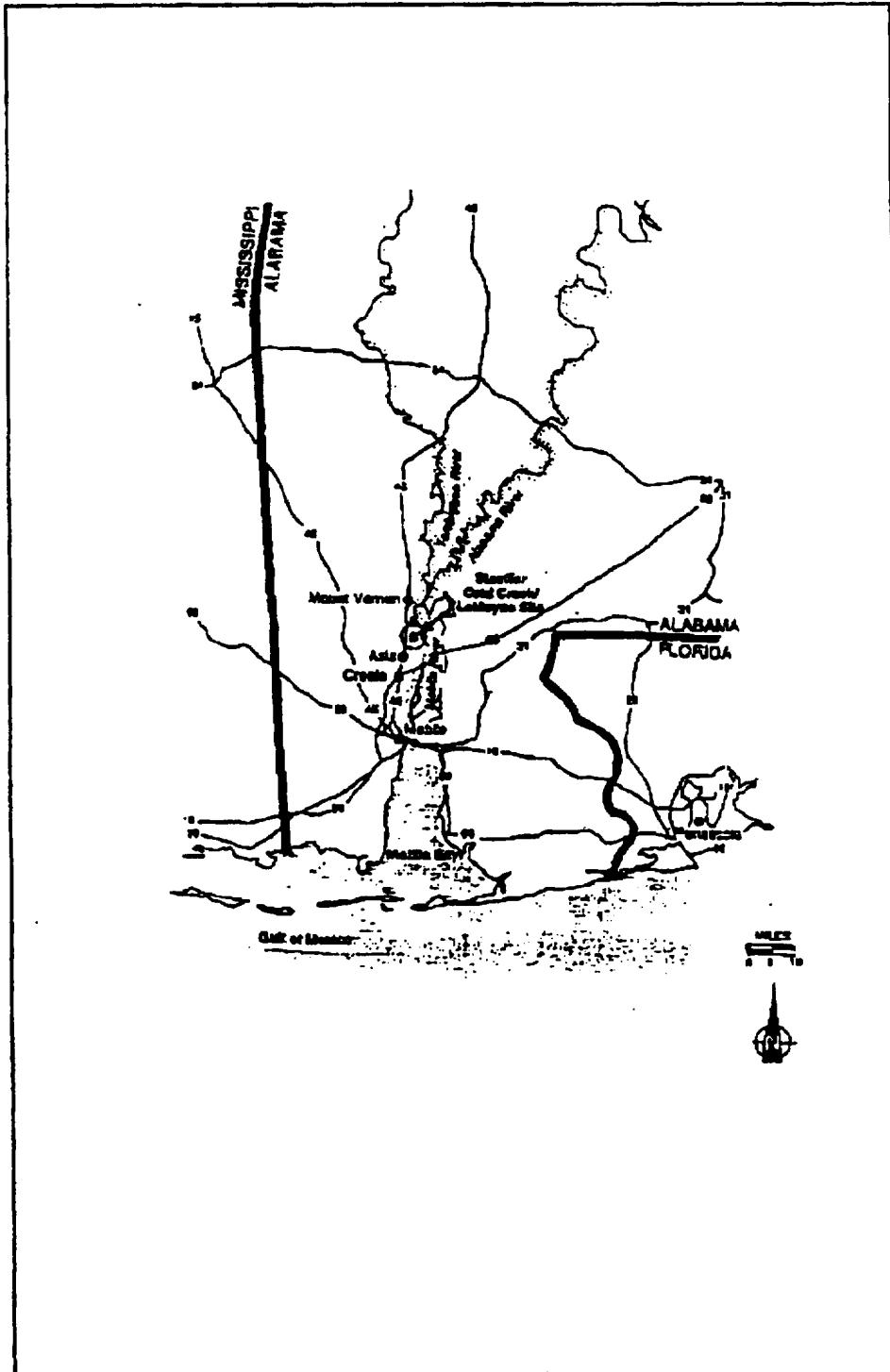


Figure 1 - Area Map

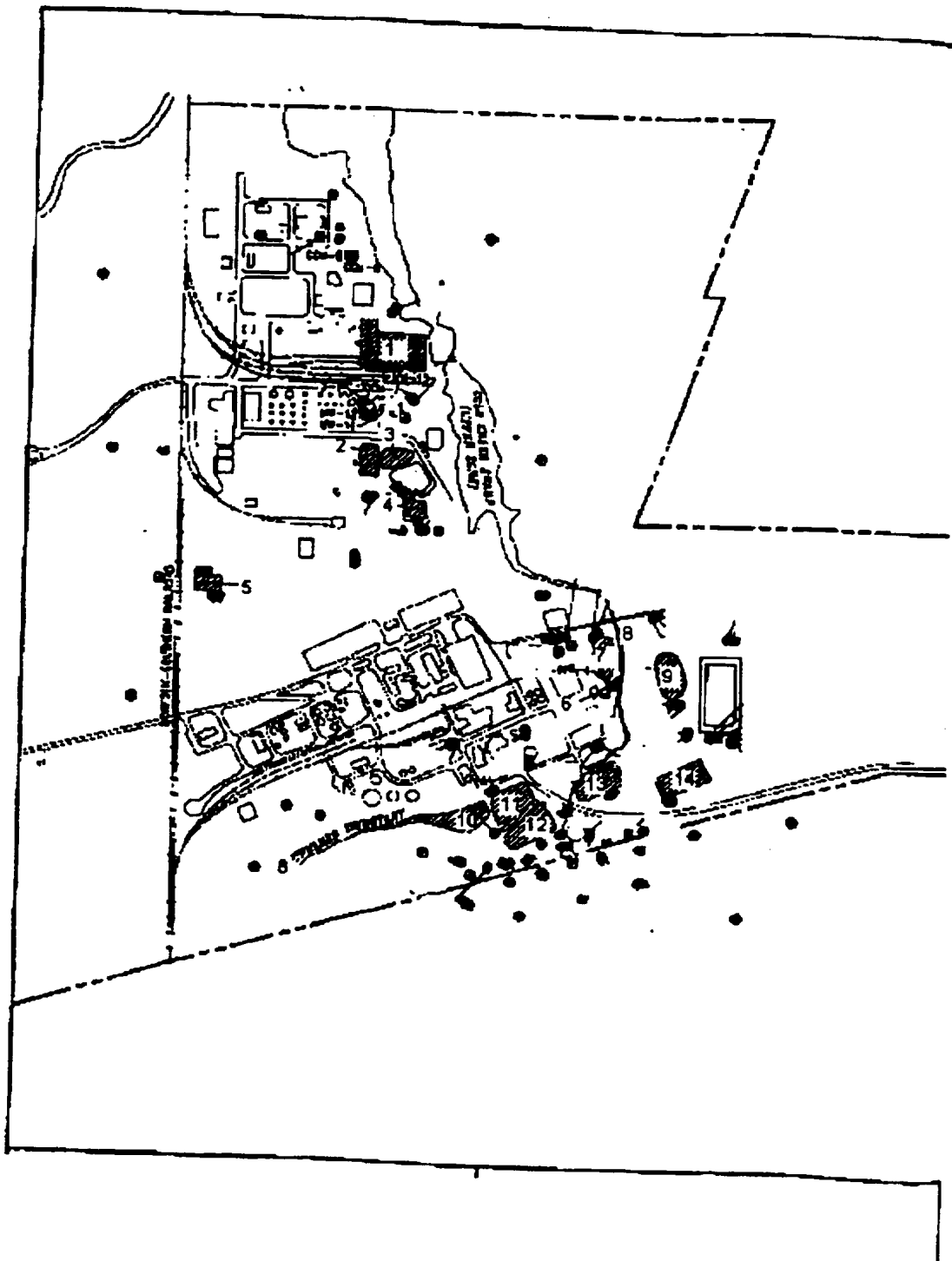


Figure 2 - Site Map

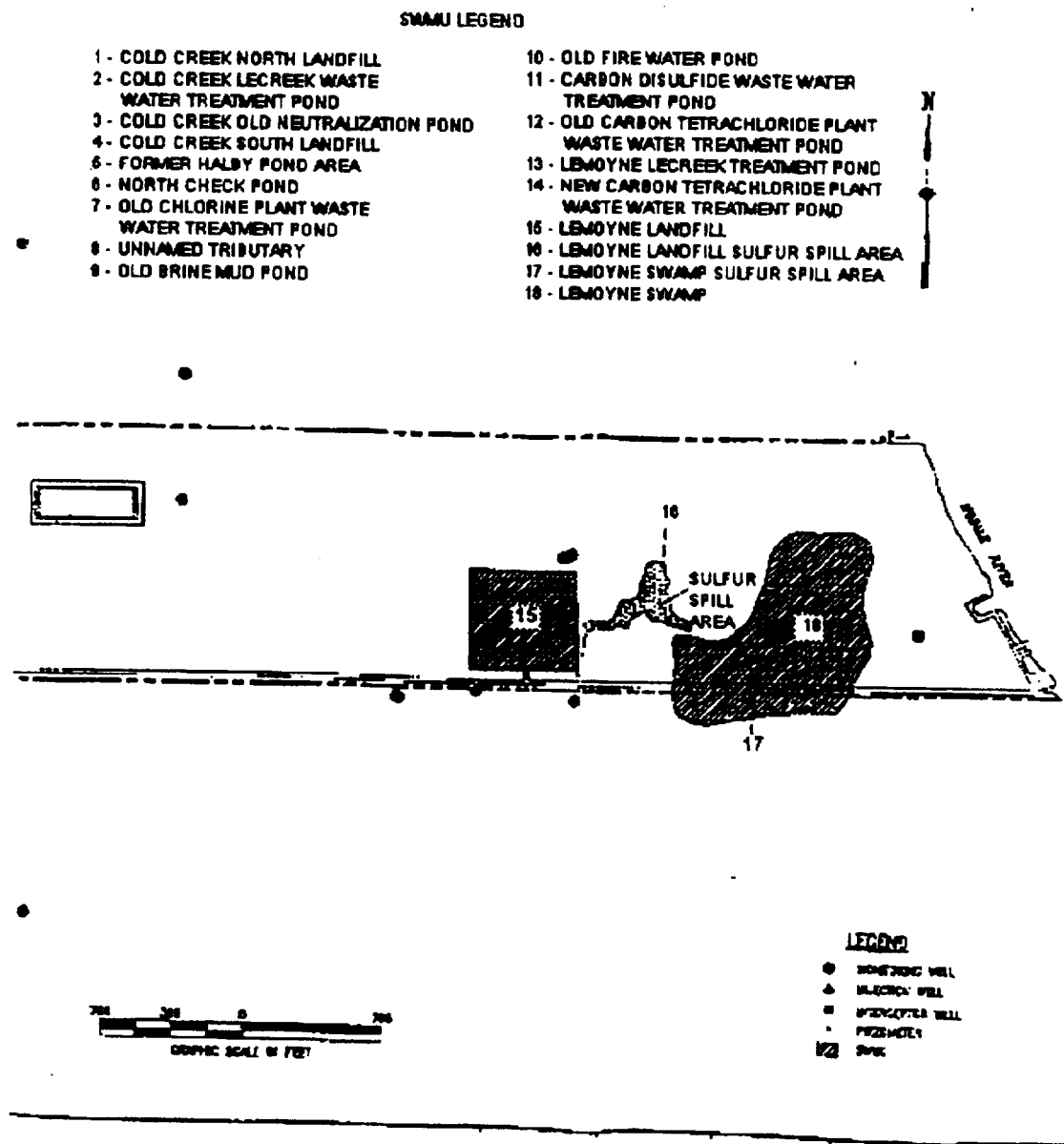


Figure 2 - Site Map (continued)

A waste pond (“the Halby Pond”) was located in the southwest portion of the former Halby area, adjacent to the Norfolk Southern Railroad. Waste products and effluents, including thiocyanates, were reportedly discharged to this pond. The pond was approximately 5,000 square feet in area and may have been clay-lined. In 1979, the facility closed the pond by filling it with soil and possibly other debris from demolition work in the former Halby area. The pond does not have an impermeable cap.

Disposal practices led to soil and groundwater contamination which was discovered by Stauffer and the Alabama Department of Environmental Management (ADEM) in the early 1970's when contaminants were detected in both on-site and off-site wells. Several improvements and waste-handling modifications were made including the construction of lined wastewater ponds and the closure of some of the old unlined ponds. In 1973, Stauffer installed twenty-one groundwater monitoring wells. By 1977, the water quality had deteriorated substantially and seven observation wells were placed at the southern property line of the Stauffer LeMoyne site. Using the results from a hydrogeological investigation performed by Stauffer, three interceptor wells accompanied by an air stripper were installed on the Stauffer LeMoyne site in late 1980. The system was approved by the Alabama Water Improvement Commission (AWIC) which is now ADEM.

The Alabama Department of Public Health (ADPH) conducted an assessment of the site in 1982. At the advice of ADPH, additional monitoring wells were installed around the LeMoyne Landfill which is located on the eastern side of the Stauffer LeMoyne site. Data from these wells formed the basis for placing the Site on the National Priorities List in September 1983.

Previous investigations at the site include a remedial investigation for Operable Unit One (OU1), which focused on groundwater. This investigation was started in 1985 and completed in 1988. A RCRA facility assessment was conducted in 1992. In addition, an evaluation of selected source areas (contaminated ponds, soils, and sediments) from the Stauffer LeMoyne site and Stauffer Cold Creek site was conducted to determine if evidence existed to suggest that the source areas were releasing contaminants to the groundwater.

In 1984 EPA Region 4 sent a general notice letter to Stauffer Chemical Company notifying them of potential liability for contamination at the Stauffer Chemical Co. Site (which originally included both the Stauffer LeMoyne and the Stauffer Cold Creek sites). Stauffer agreed to conduct a remedial investigation/feasibility study (RI/FS) under a consent agreement with EPA and the current owners completed the work. The present owner, Akzo, agreed to prepare a RI/FS for OU2. Akzo completed the RI/FS for OU2 under EPA's direction. This study included evaluations of possible risk and measures to reduce risk.

### 3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the earlier work for the Stauffer LeMoyne and Stauffer Cold Creek sites, a community relations plan was completed in September 1985. In May 1986, EPA distributed a fact sheet describing the site history and findings of investigations conducted at the sites. A fact sheet

announcing EPA's, proposed plan for Operable Unit One for both sites was issued in July 1989. A public comment period with a public meeting was opened to solicit comments on the proposed remedial action at both sites. EPA signed a Record of Decision for OU1 of the Stauffer LeMoyne and Stauffer Cold Creek sites on September 17, 1989.

The public comment period on the proposed plan for this ROD (operable unit two) was July 31, 1998 through September 30, 1998. A public meeting was not requested by the public. The administrative record was available to the public at both the information repository maintained at the Satsuma Branch Library in Satsuma, Alabama, and at the EPA Region IV Library at 61 Forsyth Street in Atlanta, Georgia. The notice of availability of these documents was published in the Mobile Register on July 31, 1998. The notice of the extension to the public comments period was published on September 3, 1998 in the Mobile Register. Responses to the significant comments received during the public comment period are included in the Responsiveness Summary which is part of this ROD (Appendix A).

This decision document presents the selected remedial action for operable unit two of the Stauffer LeMoyne site, chosen in accordance with CERCLA, as amended, and the NCP. The decision for this Site is based on the administrative record. The requirements under Section 117 of CERCLA/SARA for public and state participation have been met.

#### 4.0 SCOPE AND ROLE OF OPERABLE UNIT

EPA has organized the work at this Superfund Site into three operable units (OUs). The Site was divided into three operable units after EPA determined that additional investigations and treatability studies were necessary before EPA could make decisions on the source areas and swamp. These units are:

- OU 1: Contaminated groundwater underlying the Site which is being addressed by an ongoing operations and maintenance of the pump and treat remedy. EPA signed a ROD for OU1 on September 17, 1989. The purpose of operable unit one was to initiate groundwater restoration and reduce contaminant migration into the groundwater. Future ingestion of groundwater extracted from the aquifer poses a potential risk to human health because EPA's acceptable risk range is exceeded and concentrations of contaminants are greater than the maximum contaminant levels for drinking water (as specified in the Safe Drinking Water Act).
- OU 2: Source areas on the Site. This OU originally included 18 separate source areas - six closed wastewater ponds, two inactive ponds, two active ponds, three surface water bodies, two spill areas, and three landfills - for the Stauffer Cold Creek and Stauffer LeMoyne facilities. Fourteen of these source areas are included in the Stauffer LeMoyne site. The purpose of this operable unit is to remove sources of contamination which can result in further groundwater contamination. This operable unit is addressing the principal threat of thiocyanate which is migrating from subsurface soft into the groundwater

- OU 3: Cold Creek Swamp. Activities at the Stauffer LeMoyne Site have contributed to contamination in the Cold Creek Swamp. EPA signed a ROD for OU3 on September 27, 1993. The purpose of this operable unit is to remove contamination from the swamp so that it no longer poses a threat to human health or the environment. This operable unit is in the remedial design phase and is addressing the principal threat of surface water and sediment contamination which poses a current and potential threat to human health and the environment.

## 5.0 SUMMARY OF SITE CHARACTERISTICS

The conceptual site model for Operable Unit Two involves wastewater ponds, a landfill, and drums and tanks as the primary sources. Infiltration/percolation from the ponds and landfill and spills from the drums and tanks served as the primary release mechanism into the soil. Secondary release mechanisms from the soil include dust and/or volatile emissions which could be carried by wind to human and ecological receptors, infiltration/percolation into the groundwater which could carry contaminants to human receptors, and storm water runoff which could carry contaminants by surface water or sediments to human or ecological receptors.

### 5.1 GEOLOGY/SOILS

The geology beneath the Stauffer LeMoyne Site can be characterized as marine alluvial deltaic sediments. Two shallow clayey-sand units extend to depths of 120 feet along the western area of the site and thin slightly to bottom depths of 80 feet along the eastern river shoreline. This surficial clayey-sand formation comprises the shallow aquifer and resides atop a dense-stiff bluish green clay formation which forms an aquaclude with a slight dip toward the west and ranges in thickness from 40 to 60 feet. Shallow sediments are comprised of fine to medium grained, clean quartz sands, reddish-brown to grayish tan in color. These sands are interbedded with grey-clay strata, yellowish-brown to grey silty-clay lenses and quartz-gravel beds forming the upper unconsolidated sand unit of the shallow aquifer. This shallow zone exhibits low to moderate permeabilities caused by interbedding and discontinuous clayey strata across the Site. The upper sand unit extends to depths of 50 to 60 feet along the western area of the Site, thinning to depths of 30 to 50 feet along the eastern shoreline area. Lower sands of the shallow aquifer are cleaner, coarser, and more angular with depth even occurring as 1/4 inch quartz gravel layers within this lower zone. These coarse, clean sands comprise the water source as they exhibit moderate to relatively high permeabilities and transmissivities. A relatively shallow clay layer in the western portion of the Site may effectively separate the shallow aquifer into two water-bearing zones and produce semi-confined conditions in the aquifer in certain areas. The Site is underlain by a basal Miocene-age blue-green clay that acts as a confining layer below the shallow aquifer.

Two main U.S. Department of Agriculture soil types dominate the Site. The first is the Izagora-Bethera/Annemaine group which is common in coastal drainage areas, exhibit good drainage and support woodland vegetation dominating the western-central portion of the Site. The other is the Dorovan-Levy soil type which is common to coastal flooded areas, exhibiting hydric or saturated conditions most of the year. This soil type covers most of the Mobile River shoreline area. The

Izagom soil type is characterized as a loamy-marine sediment with a high available water capacity and is usually well to moderately well drained, with poor fertility due to low organic content. The soil type is typically acidic and allows for a deep root zone. The Halby Pond area is located atop the Izagora soils onsite. The Bethera Group is characterized by its location in shallow depressions or drainage areas with poor drainage. Typically, the soil group consists of silty-clay loam which is frequently wet from constant contact with surface or groundwater. The Bethera soil group exhibits a high available water capacity, is low in natural fertility, has low to moderate organic content, and is usually acidic. These sods are common along the Carbon Tetrachloride/Carbon Disulfide ponds and extend northward in the Unnamed Tributary which runs from south side of the Site to the Cold Creek Swamp located on the Stauffer Cold Creek site. The Annemaine Group is characterized by its location in saturated or damp areas (year-round). The soil group is composed of silts and clays which are mostly wet or damp. The Annemaine group exhibits a high availability of water capacity, frequently contains organics with moderate to low fertility, and is usually acidic. The Dorovan-Levy association is limited in extent to the Mobile River shoreline. These soils are characterized as very poorly drained, organic-muck sediments which can support vegetation and coastal forests. Typically, these soils are very fertile, always moist, and provide wildlife habitat for coastal foraging fauna.

## 5.2 SURFACE WATER

Surface drainage from the western portion of the Stauffer LeMoyne site is toward an unnamed stream (the Unnamed Tributary) which flows northward toward the Cold Creek Swamp. The eastern portion of the Stauffer LeMoyne site is adjacent to and drains toward the Mobile River. Flooding potential at the site is considered to be minimal.

## 5.3 HYDROGEOLOGY

Prior to industry utilizing the groundwater, the direction of groundwater flow was eastward toward the Mobile River and the depth to groundwater ranged from 0 to 20 feet below ground surface. Pumping of wells for industrial water supply on the adjacent Courtaulds property has resulted in a lowering of the water table to between 25 and 75 feet below ground surface. Furthermore, direction of groundwater flow has been changed to southwest on the western portion of the Site and to the southeast on the eastern portion. Most of the industries and local communities in the area obtain water from the surficial aquifer.

## 5.4 NATURE AND EXTENT OF CONTAMINATION

EPA identified 14 potential source areas at the Stauffer LeMoyne site. Five are closed wastewater treatment (WWT) ponds:

- Old Carbon Disulfide WWT Pond
- Old Chlorine Plant WWT Pond
- Chlorine Plant North Check Pond

- Old Brine Mud Pond, and
- Halby Treatment Pond.

Two units are inactive ponds:

- Old Carbon Tetrachloride Plant WWT Pond, and
- New Carbon Tetrachloride Plant WWT Pond.

One is an active pond:

- LeMoyne LeCreek WWT Pond.

Three units are associated with surface water bodies. One is man-made:

- the Old Firewater Pond,

and two are natural:

- the Unnamed Tributary, and
- LeMoyne Swamp.

Two units are associated with sulfur spills:

- LeMoyne Swamp Sulfur Spill Area, and
- LeMoyne Landfill Sulfur Spill Area.

One unit is a landfill:

- LeMoyne Landfill.

During the first remedial investigation in 1988, sampling was conducted around the ponds and landfills at the Site. Soil borings were made around the ponds and samples were analyzed for contaminants of potential concern. Analyses of composite soil samples associated with the Old Carbon Tetrachloride WWT Pond and the Old Carbon Disulfide WWT Pond found low levels of carbon tetrachloride and carbon disulfide. Soil samples from the Halby Pond detected levels of copper and zinc above background. Cyanide and thiocyanate were also found in Halby Pond samples (Table 5-1).

A background surface water sample was collected from the Unnamed Tributary near the southern edge of the Stauffer LeMoyne site. The only contaminants detected were mercury and zinc. Four sediment samples and one surface water sample were collected from the LeMoyne Swamp.

Concentrations of mercury, arsenic, beryllium, chromium, lead, and nickel were detected at or near background levels. Concentrations of copper and zinc were elevated in comparison to background levels.

<b>TABLE 5-1 - SUMMARY OF MAXIMUM CARBON TETRACHLORIDE POND SOIL BORING DATA</b>		
<b>BORING DEPTH (FEET)</b>	<b>CARBON DISULFIDE (UG/KG)</b>	<b>CARBON TETRACHLORIDE (UG/KG)</b>
Surface (0 - 0.5)	74	80
7	7	46
14	ND	ND
21	ND	89
28	ND	5
35	ND	9
42	ND	34

ND - Not detected

Additional remedial investigation activities were conducted at the Old Carbon Disulfide WWT Pond, the Old Carbon Tetrachloride WWT Pond, the Halby Pond, the Old Firewater Pond, and the Unnamed Tributary in 1993 and at the LeMoyne Swamp in 1994. Additional investigations were not conducted at eight of the potential source areas, because contamination at these areas were addressed by existing presumptive remedies or the areas were currently regulated under other EPA authorities. The source areas which were eliminated from further investigation were the Old Chlorine Plant WWT Pond, the Chlorine Plant North Check Pond, the Old Brine Mud Pond, the New Tetrachloride Plant WWT Pond, the LeMoyne LeCreek WWT Pond, the LeMoyne Swamp Sulfur Spill Area, the LeMoyne Landfill Sulfur Spill Area, and the LeMoyne Landfill. The field activities at the remaining six source areas included soil borings and sampling, surface water and sediment sampling, and fish tissue sampling. Four soil borings were drilled at both the Old Carbon Disulfide WWT Pond and the Old Carbon Tetrachloride WWT Pond. Nineteen soil borings were drilled at the Halby Pond. Sediment samples were collected from the Unnamed Tributary, the Old Firewater Pond, and the LeMoyne Swamp. Surface water samples were taken in the same locations at the sediment samples and also in the Old Carbon Tetrachloride WWT Pond.

The ecological field investigation conducted in April 1994 involved the LeMoyne Swamp, the Unnamed Tributary and the Old Firewater Pond. Fish samples were collected from the LeMoyne Swamp. A benthic community analysis and fish community survey were conducted in the

Unnamed Tributary and the Old Firewater Pond. Physicochemical parameters (water temperature, dissolved oxygen, pH and conductivity) were also analyzed in these areas.

<b>TABLE 5-2 - SUMMARY OF MAXIMUM CARBON DISULFIDE POND SOIL BORING DATA</b>		
<b>DEPTH(FEET)</b>	<b>CARBON DISULFIDE (UG/KG)</b>	<b>CARBON TETRACHLORIDE (UG/KG)</b>
Surface (0 - 0.5)	ND	4
7	ND	ND
14	88	800E
21	12	51
28	4	31
35	ND	18
42	840	9700

ND - Not detected

E - Exceeded calibration range of GC/MS

Sampling results from the soil borings at the Old Carbon Tetrachloride WWT Pond and the Old Carbon Disulfide WWT Pond, are presented in Tables 5-1 and 5-2.

Four sets of data have been collected in the former Halby area. In the 1986 site investigation, three soil borings indicated the presence of elevated levels of thiocyanates at depths of up to 40 feet. The remedial investigation conducted in 1993 consisted of three angled borings, two eight-foot borings, and 14 30-foot borings, with analysis for carbon disulfide, thiocyanates, and cyanide. In 1995 four additional soil samples for thiocyanate analysis were collected at a depth of 30 feet at locations approximating the locations of four earlier borings. Additional data was collected in 1998 to further characterize the site. Table 5-3 summarized the data from the former Halby area.

Some studies indicate that cyanide results obtained from soil analyses in the former Halby area may be false positives caused by the nature of the analytical method utilized. Nevertheless, because this premise has not been adequately demonstrated, cyanide remains as a contaminant of concern at the Site. Future analysis using improved analytical methods may demonstrate that cyanide is not present in the soil.

<b>TABLE 5-3 - SUMMARY OF MAXIMUM FORMER HALBY AREA BORING DATA</b>			
<b>BORING DEPTH(FEET)</b>	<b>CARBON DISULFIDE (UG/KG)*</b>	<b>THIOCYANATE (MG/KG)**</b>	<b>CYANIDE (MG/KG)**</b>
Surface (0-0.5)	ND	11A	3.57A
5-10 Feet	25	2000	12.3J
15-21 Feet	280	9000	5.15J
25-30 Feet	270	90,000***	18.6J
35-40 Feet	NS	300	13.3J

ND - Not detected

NS - Not sampled

J - Estimated value

A - Average value

\* - 1993 data

\*\* - 1998 data

\*\*\* - Result may be a sampling anomaly. Next highest value is 5000 mg/kg.

Surface water sampling results for the Old Carbon Tetrachloride WWT Pond were non-detectable for carbon tetrachloride and carbon disulfide. Surface water and sediment sampling results for the Old Firewater Pond and the Unnamed Tributary are presented in Tables 5-4 and 5-5.

<b>TABLE 5-4 - SUMMARY OF MAXIMUM SURFACE WATER AND SEDIMENT DATA AT THE OLD FIREWATER POND</b>		
<b>CONTAMINANT</b>	<b>SURFACE WATER (UG/L)</b>	<b>SEDIMENT (UG/KG)</b>
Carbon disulfide	14	ND
Carbon tetrachloride	ND	ND
Chromium	ND	260
Iron	680	38,500
Mercury	ND	10.6*
Zinc	64.4	8,790
Cyanide	ND	0.835
Thiocyanate	ND	ND

ND - Not detected

\* - Duplicate analysis not within control limits

Mercury contamination in the LeMoyne Swamp sediment ranged from below 0.22 mg/kg to 1.7 mg/kg. Contamination in a nearby reference area ranged from 0.22 mg/kg to 0.28 mg/kg. Mercury contamination in fish tissue from LeMoyne Swamp ranged from below 0.08 mg/kg to 0.84 mg/kg. Mercury contamination in fish from the reference area ranged from below 0.08 mg/kg to 0.78 mg/kg.

## 5.5 CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Current on-site land use is industrial. The Stauffer LeMoyne Site is owned and operated by Akzo Nobel Chemicals, Inc. (Akzo) which manufactures carbon disulfide, sulfuric acid, and a proprietary sulfur compound there. The Site is currently surrounded by additional industrial facilities and the Mobile River. The anticipated future land use for this area is industrial.

The groundwater beneath the Site is classified as Class II groundwater, which is a potential source of drinking water (Guidelines for ground-water classification under the EPA ground-water protection strategy, Final Draft, November 1986, Office of Ground-water Protection, Office of Water, U.S.E.P.A.). This groundwater is currently used for industrial purposes, but not for drinking water sources. The USGS report entitled Geohydrogeology and Susceptibility of Major Aquifers to Surface Contamination in Alabama; Area 13 (1988) designates the area around the

<b>TABLE 5-5 - SUMMARY OF MAXIMUM SURFACE WATER AND SEDIMENT DATA AT THE UNNAMED TRIBUTARY</b>		
<b>CONTAMINANT</b>	<b>SURFACE WATER (UG/L)</b>	<b>SEDIMENT (UG/KG)</b>
Carbon disulfide	28	ND
Carbon tetrachloride	ND	ND
Chromium	3.2B	72.1N
Iron	969	17,800*
Mercury	ND	3.5N*
Zinc	46.4	325
Cyanide	ND	0.835
Thiocyanate	ND	29.6

ND - Not detected

B - Reported value is less than the contract Required Detection Limit, but greater than the Instrument Detection Limit

\* - Duplicate analysis not within control limits

Site as a recharge area for a major aquifer which is highly susceptible to surface contamination. The groundwater beneath the Site is not expected to be used as a drinking water source in the next 30 years, since alternative water supplies from other aquifers are available. However, these alternative water supplies utilize groundwater near the Site as sources of drinking water.

## 6.0 SUMMARY OF OPERABLE UNIT TWO RISKS

CERCLA directs EPA to conduct a baseline risk assessment to determine whether a Superfund Site poses a current or potential threat to human health and the environment in the absence of any remedial action. The baseline risk assessment provides the basis for determining whether or not remedial action is necessary and the justification for performing remedial action. Based upon this analysis EPA determined that the subsurface soil poses a risk to potential users of groundwater.

The migration of subsurface contaminants into the groundwater would pose a risk for potential adult and child residential users of the groundwater. Direct exposure to soil does not pose a significant risk to on-site workers. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

## 6.1 CONTAMINANTS OF CONCERN

The majority of the wastes and residues generated by production operations at the facility have been managed, treated, and disposed of onsite throughout the Site's history. The chemicals measured in the various environmental media during the RI were evaluated for inclusion as chemicals of potential concern in the risk assessment by application of screening criteria. Cyanide, thiocyanate, carbon tetrachloride, carbon disulfide, chromium, mercury, and zinc were identified as chemicals of potential concern (COPCs) for OU2 of the Site. These compounds were found in surficial and subsurface soils, sediment, and surface water. Table 6-1 presents the COPCs and their concentration ranges.

## 6.2 EXPOSURE ASSESSMENT

Whether a chemical is actually a concern to human health and the environment depends upon the likelihood of exposure, i.e. whether the exposure pathway is currently complete or could be complete in the future. A complete exposure pathway (a sequence of events leading to contact with a chemical) is defined by the following four elements:

- A source and mechanism of release from the source,
- A transport medium (e.g., surface water, groundwater, air) and mechanisms of migration through the medium,
- The presence or potential presence of a receptor at the exposure point, and

- A route of exposure (ingestion, inhalation, dermal adsorption).

If all four elements are present, the pathway is considered complete.

An evaluation was undertaken of all potential exposure pathways which could connect chemical sources in source areas (soil and subsurface soil) at the Site with potential receptors. All possible pathways were first hypothesized and evaluated for completeness using EPA's criteria. The current pathways represent exposure pathways which could exist under current Site conditions while the future pathways represent exposure pathways which could exist, in the future, if the current exposure conditions change (such as by installing drinking water wells). For both current and future exposure scenarios, EPA assumed the Site would remain in industrial use. Therefore, residential scenarios were not examined. Exposure by each of these pathways was mathematically modeled using generally conservative assumptions.

The current pathways are:

- incidental ingestion of surface water, sediment, or soil by maintenance workers,
- potential dermal exposure by on-site maintenance workers to on-site surface soils, sediment or surface water,
- potential inhalation exposure by on-site maintenance workers to dust, and
- potential inhalation of volatile emissions by on-site maintenance workers.

The future pathways are:

- potential oral exposure by on-site construction workers to on-site surface soils,
- potential dermal exposure by on-site construction workers to on-site surface soils,
- potential inhalation exposure by on-site construction workers to dust,
- potential inhalation of volatile emissions by on-site construction workers, and
- potential ingestion of groundwater from a future drinking water well.

EPA assumed for this assessment that there would be no significant human exposure at the LeMoyne Swamp, since the area is not subject to construction or maintenance activities and is not easily accessible to trespassers from the Mobile River.

TABLE 6-1 - SUMMARY OF CHEMICALS OF POTENTIAL CONCERN					
Media	Chemical	Concentration Detected		Units of Measure	Frequency of Detection
		Minimum	Maximum		
Halby Area Soil	Carbon Disulfide	4	280	ppb	10/78
	Cyanide	0.118	59.6	ppm	32/78
	Thiocyanate	3.43	90,000**	ppm	52/78
Old Carbon Tetrachloride and Carbon Disulfide WWT Ponds Soil	Carbon Disulfide	4	840	ppb	10/52
	Carbon Tetrachloride	1	9700	ppb	26/52
Old Firewater Pond Sediment	Zinc	1,400	8,790	ppm	3/3
	Chromium	171	260	ppm	3/3
	Mercury	3.9*	10.6*	ppm	3/3
	Cyanide	0.835	0.835	ppm	1/3
Unnamed Tributary Sediment	Zinc	14.1	325	ppm	5/5
	Chromium	5.6N	72.1N	ppm	5/5
	Mercury	0.6N*	3.5N*	ppm	5/5
LeMoyne Swamp Sediment	Mercury	0.35	1.7	ppm	7/7
Old Firewater Pond Surface Water	Carbon Disulfide	11	14	ppb	3/3
Unnamed Tributary Surface Water	Carbon Disulfide	12	28	ppb	3/5
	Zinc	16.8	46.4	ppb	5/5

ppm - parts per Million

ppb - parts per billion

\* - Duplicate analysis not within control limits

\*\* - Result may be a sampling anomaly. Next highest value is 9,000.

The exposure point concentrations for each of the chemicals of concern and the exposure assumptions for each pathway were used to estimate the chronic daily intakes for the potentially complete pathways, with the exception of the groundwater pathway. The chronic daily intakes were then used in conjunction with cancer potency factors and noncarcinogenic reference doses to evaluate risk.

Exposure concentrations are provided in Tables 6-2, 6-3, and 6-4. All exposure concentrations are based on the 95% upper confidence limit on the arithmetic mean concentration for each chemical. Air concentrations were calculated using models from EPA's *Superfund Exposure Assessment Manual* (USEPA, 1988).

Exposure assumptions for an on-site maintenance worker are as follows:

- Ingestion rate is 50 ml/day for water and 50 mg/day for sediment and soil.
- Exposure frequency is 24 days/year; exposure duration is 25 years.
- Skin surface area exposed is 3,600 cm<sup>2</sup>; inhalation rate is 0.833 m<sup>3</sup>/hour; body weight is 70 kg.

TABLE 6-2 - EXPOSURE CONCENTRATIONS AT HALBY POND AREA			
Maintenance Worker			
Chemical	Soil Concentration, Surface Only (mg/kg)	Air (VOC) Concentration from Soil (mg/m <sup>3</sup> )	Dust Concentration from Soil, Traffic Only (mg/m <sup>3</sup> )
Carbon disulfide	1.96 x 10 <sup>-3</sup>	5.03 x 10 <sup>-5</sup>	8.65 x 10 <sup>-9</sup>
Cyanide	2.75 x 10 <sup>-1</sup>	—	1.21 x 10 <sup>-6</sup>
Thiocyanate	1.23 x 10 <sup>+1</sup>	—	5.41 x 10 <sup>-5</sup>
Construction Workers			
Chemical	Soil Concentration, Surface Only (mg/kg)	Air (VOC) Concentration from Soil (mg/m <sup>3</sup> )	Dust Concentration from Soil, Traffic Only (mg/m <sup>3</sup> )
Carbon disulfide	1.67 x 10 <sup>-3</sup>	4.28 x 10 <sup>-4</sup>	7.25 x 10 <sup>-8</sup>
Cyanide	3.07 x 10 <sup>0</sup>	—	1.42 x 10 <sup>-5</sup>
Thiocyanate	3.46 x 10 <sup>+2</sup>	—	1.60 x 10 <sup>-3</sup>

- Averaging time is 25 years for noncarcinogens and 70 years for carcinogens.
- Soil dermal adherence factor is 1 mg/cm<sup>2</sup>; dermal absorption factor is 0.25 (unitless) for VOCs and 0.01 for inorganics.

Exposure assumptions for an on-site construction worker are as follows:

- Exposure frequency is 40 days/year; exposure duration is 1 year.
- Skin surface area exposed is 3,600 cm<sup>2</sup>; inhalation rate is 1.25 m<sup>3</sup>/hour; body weight is 70 kg.
- Averaging time is 1 year for noncarcinogens and 70 years for carcinogens.
- Soil dermal adherence factor is 1 mg/cm<sup>2</sup>; dermal adsorption factor is 0.25 for VOCs and 0.01 for inorganics.
- Ingestion rate is 50 mg/day; exposure time is 8 hours/day.

TABLE 6-3 - EXPOSURE CONCENTRATION AT CARBON DISULFIDE POND AND OIL CARBON TETRACHLORIDE WWT POND			
Maintenance Workers			
Chemical	Soil Concentration, Surface Only (mg/kg)	Air (VOC) Concentration from Soil (mg/m <sup>3</sup> )	Dust Concentration from Soil, Traffic Only (mg/m <sup>3</sup> )
Carbon Disulfide	2.67 x 10 <sup>-2</sup>	6.83 x 10 <sup>-4</sup>	1.18 x 10 <sup>-7</sup>
Carbon Tetrachloride	2.81 x 10 <sup>-2</sup>	3.28 x 10 <sup>-4</sup>	1.24 x 10 <sup>-7</sup>
Construction Workers			
Chemical	Soil Concentration, Surface Only (mg/kg)	Air (VOC) Concentration from Soil (mg/m <sup>3</sup> )	Dust Concentration from Soil, Traffic Only (mg/m <sup>3</sup> )
Carbon Disulfide	5.23 x 10 <sup>-2</sup>	1.34 x 10 <sup>-3</sup>	2.43 x 10 <sup>-7</sup>
Carbon Tetrachloride	5.59 x 10 <sup>-1</sup>	6.51 x 10 <sup>-3</sup>	2.59 x 10 <sup>-6</sup>

VOC - Volatile organic chemicals

### 6.3 TOXICITY ASSESSMENT

Toxicity assessment is a two-step process whereby the potential hazards associated with route-specific exposure to a given chemical are (1) identified by reviewing relevant human and animal studies; and (2) quantified through analysis of dose-response relationships. EPA has conducted numerous toxicity assessments that have undergone extensive review within the scientific community. EPA toxicity assessments and the resultant toxicity values were used in the baseline risk assessment to determine both carcinogenic and non-carcinogenic risks associated with each chemical of concern and route of exposure. EPA toxicity values that are used in this assessment include:

- cancer slope factors (CSFs) for carcinogenic effects, and
- reference dose values (RfDs) for non-carcinogenic effects.

TABLE 6-4 - EXPOSURE CONCENTRATION AT OLD FIREWATER POND AND UNAMED TRIBUTARY			
Maintenance Workers			
Chemical	Surface Water Concentration (mg/L)	Sediment Concentration (mg/kg)	Air Condition from Surface Water (mg/m <sup>3</sup> )
Carbon Disulfide	$1.76 \times 10^{-2}$	$4.30 \times 10^{-3}$	$2.49 \times 10^{-1}$
Carbon Tetrachloride	$3.65 \times 10^{-4}$	$1.33 \times 10^{-3}$	$3.66 \times 10^{-3}$
Chromium	$3.27 \times 10^{-3}$	$1.54 \times 10^{+2}$	-
Cyanide	$5.00 \times 10^{-3}$	$3.49 \times 10^{-1}$	-
Mercury	$9.54 \times 10^{-5}$	$6.05 \times 10^0$	-
Thiocyanate	$2.50 \times 10^{-2}$	$1.29 \times 10^{+1}$	-
Zinc	$5.41 \times 10^{-2}$	$3.49 \times 10^{+3}$	--

Cancer slope factors are route-specific values derived only for compounds that have been shown to cause an increased incidence of tumors in either human or animal studies. The slope factor is an upper bound estimate of the probability of a response per unit intake of a chemical over a lifetime and is usually determined by high-dose to low-dose extrapolation from human or animal studies. When an animal study is used, the final slope factor has been adjusted to account for extrapolation of animal data to humans. If the studies used to derive the slope factor were conducted for less than the life span of the test organism, the final slope factor has been adjusted

to reflect risk associated with lifetime exposure. Chromium which is present in the Old Firewater Pond and Unnamed Tributary is considered to be carcinogenic if it is in the hexavalent form and it exposure occurs by the inhalation route. Since the only inhalation pathway at the Old Firewater Pond and Unnamed Tributary is inhalation of volatile compounds, chromium is not an issue as a carcinogen at this Site. Carbon tetrachloride is the only carcinogenic chemical of potential concern (COPC) at this Site. Carbon tetrachloride is classified by EPA as a probable human carcinogen (EPA weight of evidence Class B2). Table 6-5 presents cancer slope factors for carbon tetrachloride. The oral slope factor and inhalation unit risk number were obtained from EPA's Integrated Risk Information System (IRIS). An inhalation slope factor was derived from the unit risk using standards assumptions. The dermal slope factor was established by adjustment of the oral slope factor by the default oral absorption factors.

TABLE 6-5 - CANCER SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN			
Chemical	Oral Slope Factor (mg/kg-day) <sup>-1</sup>	Dermal Slope Factor (mg/kg-day) <sup>-1</sup>	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>
Carbon Tetrachloride	0.13	0.16	0.053

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. Reference doses are ideally based on studies where either animal or human populations were exposed to a given compound by a given route of exposure for the major portion of the life span (referred to as a chronic study). The RfD is derived by determining dose-specific effect levels from all the available quantitative studies, and applying uncertainty factors to the most appropriate effect level to determine a RfD for humans. The RfD represents a threshold for toxicity. RfDs are derived such that human lifetime exposure to a given chemical via a given route at a dose at or below the RfD should not result in adverse health effects, even for the most sensitive members of the population. Table 6-6 presents the reference doses for the chemicals of potential concern.

Chronic oral toxicity RfDs were obtained from IRIS for all COPCs except thiocyanate. No toxicity data for thiocyanate is available in either IRIS or the Health Effects Assessment Summary Tables (HEAST). The EPA Health Risk Superfund Technical Support Center calculated a provisional RfD for thiocyanate, which was used in the risk assessment for this Site.

Subchronic RfDs can be used when the exposure duration is less than seven years. However, to be conservative in this risk assessment, the chronic oral RfDs were used for the subchronic exposures for carbon disulfide, chromium, cyanide, mercury, thiocyanate, and zinc. Carbon tetrachloride has an established subchronic toxicity value.

Dermal toxicity values were calculated from the chronic and subchronic oral RfDs by applying chemical-specific oral adsorption factors. EPA default adsorption values for volatiles (80%), semi-volatiles (50%), and inorganics (20%) were used to adjust the oral toxicity values.

Inhalation reference concentrations are not available, except for mercury in IRIS and carbon disulfide in HEAST. These values were converted to RfDs for the risk assessment. For the other COPCs, the oral RfDs were substituted as inhalation RfDs to evaluate inhalation exposure.

#### 6.4 RISK CHARACTERIZATION

Human health risks are characterized for potential carcinogenic and non-carcinogenic effects by combining exposure and toxicity information. For carcinogens, risks are generally expressed as the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

$$\text{Risk} = \text{CDI} \times \text{SF}$$

where: risk = a unitless probability (e.g.,  $10^5$ ) of an individual's developing cancer  
CDI = chronic daily intake averaged over 70 years (mg/kg-day)  
SF = slope factor, expressed as (mg/kg-day)<sup>-1</sup>

These risks are probabilities that are generally expressed in scientific notation (e.g.,  $10^6$ ). For example, an excess lifetime cancer risk of  $1 \times 10^6$  indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is  $10^{-4}$  to  $10^{-6}$ .

EPA considers individual excess cancer risks in the range of  $10^4$  to  $10^{-6}$  as protective; however the  $10^{-6}$  risk level is generally used as the point of departure for setting cleanup levels at Superfund sites. The point of departure risk level of  $10^6$  expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range. The risks calculated for human direct contact at this site are below the  $10^{-6}$  risk level (Table 6-7).

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). A HQ which exceeds one (1) indicates that the daily intake from a scenario exceeds the chemical's reference dose. By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. An HI which exceeds unity indicates that there may be a concern for potential health effects resulting from the cumulative exposure to multiple contaminants within a single medium or across media.

TABLE 6-6 - REFERENCE DOSES FOR CHEMICALS OF POTENTIAL CONCERN						
Chemical	Chronic Oral RfD (mg/kg-day)	Chronic Dermal RfD (mg/kg-day)	Chronic Inhalation RfD (mg/kg-day)	Subchronic Oral RfD (mg/kg-day)	Subchronic Dermal RfD (mg/kg-day)	Subchronic Inhalation RfD (mg/kg-day)
Carbon Disulfide	0.1	0.08	0.0029	0.1	0.08	0.0029
Carbon Tetrachloride	0.0007	0.00056	0.0007	0.007	0.0056	0.007
Chromium	1	0.2	1	1	0.2	1
Cyanide	0.02	0.004	0.02	0.02	0.004	0.02
Mercury	0.0003	0.00006	0.0003	0.0003	0.00006	0.0003
Thiocyanate	0.1	0.05	0.1	0.1	0.05	0.1
Zinc	0.3	0.06	0.3	0.3	0.06	0.3

TABLE 6-7 TOTAL RISKS ASSOCIATED WITH DERMAL CONTACT, INHALATION AND INGESTION			
AREA	SCENARIO	CANCER RISK	NON-CANCER RISK (HI)
Halby Area	Maintenance Worker	NA	$2.0 \times 10^{-4}$
Halby Area	Construction Worker	NA	$6.8 \times 10^{-3}$
Carbon Disulfide and Old Carbon Tetrachloride WWT Ponds	Maintenance Worker	$4.0 \times 10^{-8}$	$4.4 \times 10^{-3}$
Carbon Disulfide and Old Carbon Tetrachloride WWT Ponds	Construction Worker	$7.9 \times 10^{-8}$	$2.2 \times 10^{-2}$
Old Firewater Pond and Unnamed Tributary	Maintenance Worker	NA	$5.8 \times 10^{-1}$
Total Current Risk	Maintenance Worker	$4.0 \times 10^{-8}$	$5.8 \times 10^{-1}$
Total Future Risk	Construction Worker	$7.9 \times 10^{-8}$	$2.9 \times 10^{-2}$

NA - Cancer risks are not applicable to this scenario.

The HQ is calculated as follows:

$$\text{Non-cancer HQ} = \text{CDI/RfD}$$

where:

CDI = Chronic daily intake

RfD = Reference dose

CDI and RfD are expressed in the same units and represent the same exposure period ( i.e., chronic, subchronic, or short-term).

For direct exposure to soil, surface water, and sediment, the results of the risk assessment indicated that all cumulative non-carcinogenic hazards to human health were several orders of

magnitude below the threshold of concern. Table 6-7 presents the results of the risk assessment for direct exposure to soils, sediment and water at the Site.

Utilizing the SUMMERS model for soil contaminants leaching to groundwater, it was determined that soils in the Halby area could continue to leach thiocyanate and cyanide to the underlying groundwater aquifer at levels that would result in the exceedance of groundwater standards established by EPA. The SUMMERS model calculations are included in the RI/FS documents located in the Administrative Record. Although there are uncertainties in the calculation of soil remedial goals for groundwater protection, the SUMMERS model analysis is a conservative approach that does not underestimate the impacts of soil contamination on groundwater quality. Carbon disulfide was not detected in groundwater. Therefore, thiocyanate and cyanide were retained as chemicals of concern. The results of the model are supported by levels of contaminants of concern found in monitoring wells in the vicinity of the Halby area. Thiocyanate concentrations in groundwater currently exceed calculated acceptable groundwater levels (based on potential drinking water source). Cyanide concentrations in groundwater currently exceed EPA's Safe Drinking Water Act Maximum Contaminant Levels (MCLs). The soils pose an unacceptable risk to future users of groundwater as a drinking water source.

Throughout the risk assessment process, uncertainties and variabilities associated with evaluation of chemical toxicity and potential exposures exist. For example uncertainties arise in derivation of toxicity values for reference doses (RfDs) and carcinogenic slope factors (CSFs), estimation of exposure point concentrations, fate and transport modeling, exposure assumptions and ecological toxicity data. Because of the conservative nature of the risk assessment process, risks estimated in this assessment are likely to be overestimates of the true risks associated with current or potential exposure at OU 2 of the Stauffer LeMoyne Site.

## 6.5 ECOLOGICAL RISK

The LeMoyne Swamp offers habitat for aquatic, aviary, and terrestrial wildlife. Although mercury was detected in the sediments at elevated levels, the mercury fish tissue concentrations are at background levels. Mercury contamination in the LeMoyne Swamp sediment ranged from below 0.22 mg/kg to 1.7 mg/kg. Contamination in a nearby reference area ranged from 0.22 mg/kg to 0.28 mg/kg. Mercury contamination in fish tissue from LeMoyne Swamp ranged from below 0.08 mg/kg to 0.84 mg/kg. Mercury contamination in fish from the reference area ranged from below 0.08 mg/kg to 0.78 mg/kg. Foraging activities, breeding, and resident habitats occur elsewhere, indicating short term and low intensity use and exposure at the LeMoyne Swamp. The contamination at this area poses a limited risk to ecological receptors.

The source areas, except for the LeMoyne Swamp, offer a limited and poor quality habitat for area wildlife. The areas are located a significant distance from any areas capable of supporting substantial numbers of animals. The wooded areas west of the Halby Area, west of the headwaters of the tributary, and at the junction of the tributary and Cold Creek Swamp have the greatest potential to support wildlife. There is no indication that any animals in the wooded areas

frequently enter these source areas. The mowed and disturbed areas have limited habitat for foraging or movement by most species, although occasional foraging is expected. Access to these source areas is limited due to traffic and physical barriers, such as fencing. The COPCs in these areas pose a limited risk to ecological receptors (Table 6-8).

TABLE 6-8 COMPARISON OF OBSERVED CONCENTRATIONS TO WATER QUALITY CRITERIA			
Chemical	Observed Concentration (ug/L)		Criteria <sup>1</sup>
	Range	Mean	
Unnamed Tributary			
Carbon disulfide	3 - 14	7	2,100 - 162,000 <sup>1</sup>
Chromium	1.6 - 3	2.4	11 (Chromium VI) <sup>2</sup> 210 (Chromium III) <sup>2</sup>
Iron	391 - 969	582.8	1,000 <sup>2</sup>
Zinc	16.8 - 46.4	35.1	110 <sup>2</sup>
Old Firewater Pond			
Carbon disulfide	11 - 14	12.3	2,100 - 162,000 <sup>1</sup>
Iron	664 - 680	667	1,000 <sup>2</sup>
Zinc	51.6 - 64.4	59.3	110 <sup>2</sup>

<sup>1</sup>AQUIRE database. Acute and chronic range for potentially resident species including mosquitofish (*Gambusia affinis*), orange spotted sunfish (*Leponis humilis*), water flea (*Daphnia magna*), and green algae (*Chlorella pyrenoidosa*).

<sup>2</sup>Based on U.S. EPA freshwater quality criteria.

## 6.6 REMEDIATION OBJECTIVES

The remedial action objective (RAO) for OU2 of the Site is to prevent contamination from migrating to groundwater. This RAO is based on the potential beneficial groundwater use as a drinking water supply. The selected remedy will reduce concentrations of contaminants in subsurface soil to levels which will not result in exceedances of groundwater standards or action levels established by EPA for OU1 of the Site.

The establishment of health-based cleanup goals serves as an important means of guiding remedial activities. A health-based approach is warranted when cleanup standards promulgated by state or

federal agencies are not available for contaminants in soil, as well as for certain groundwater contaminants. The approach to developing health-based goals is derived from the risk assessment process. The risk assessment is essentially a process by which the magnitude of potential cancer risks and other health effects at a site can be evaluated quantitatively. A cleanup goal is established by back-calculating a health protective contaminant concentration, given a target cancer risk or hazard index which is deemed acceptable and realistic. The concept of the cleanup goal inherently incorporates the concept of exposure reduction which allows remedial alternatives to be flexible.

For thiocyanate a groundwater performance standard of 3.5 mg/l was used to calculate the protective subsurface performance standard. The thiocyanate performance standard was calculated using the reference dose established by EPA. Assumptions used in calculating the groundwater performance standard are body weight of 70 kg, water ingestion of 2 liters per day, and a provisional reference dose (RfD) of 0.1 mg/kg-day. The SUMMERS groundwater model was used to backcalculate the allowable concentration of thiocyanate in subsurface soil which would not result in exceedance of the groundwater performance standard.

For cyanide, a groundwater performance standard of 200 ug/liter was used to calculate the subsurface soil performance standard. This number is the Safe Drinking Water Act Maximum Contaminant Level for cyanide in drinking water. The SUMMERS groundwater model was used to backcalculate the allowable concentration of thiocyanate in subsurface soil which would not result in exceedance of the groundwater performance standard.

The subsurface soils at the Site currently contain concentrations of Site-related contaminants at levels which would pose an unacceptable risk to human health for potential future users of groundwater. Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

The performance standards for subsurface soil are contained in Table 6-9. Cleanup levels for contaminated subsurface soil are based on protection of groundwater.

TABLE 6-9 PERFORMANCE STANDARDS FOR SUBSURFACE SOILS	
CONTAMINANT	PERFORMANCE STANDARD (MG/KG)
Cyanide	0.47
Thiocyanate	8.5

Based on the soil sampling data and risk evaluation for OU2 and the groundwater monitoring data from OU1, EPA determined that only the subsurface soils at the former Halby area present a risk to human health and the environment. Thirteen potential source areas were eliminated from

<b>TABLE 6-10 - STATUS OF ELIMINATED POTENTIAL SOURCE AREAS</b>	
<b>POTENTIAL SOURCE AREAS</b>	<b>STATUS</b>
Old Firewater Pond	Maintenance activity to ensure adequate drainage from the pond will eliminate need for further action
Unnamed Tributary	Maintenance activity to ensure adequate drainage from the tributary will eliminate need for further action
Old Carbon Disulfide WWTP	Presumptive remedy: Pond capped in 1978-79. Supplemental remedial investigation (RI) demonstrated remedy is protective of groundwater.
Old Carbon Tetrachloride WWTP	Pond being filled with sediments removed from the Old Firewater Pond and Unnamed Tributary. Pond will be brought to grade and seeded. Supplemental RI demonstrated remedy will be protective of groundwater.
LeMoyne Swamp	No further action based on supplemental RI.
LeMoyne Landfill Sulphur Spill Area	Presumptive remedy: Removal and disposal of sulphur in an approved facility in 1994.
LeMoyne Swamp Sulphur Spill Area	Presumptive remedy: Removal and disposal of sulphur in an approved facility in 1995.
LeMoyne Landfill	Presumptive remedy: Landfill closed and capped 1994-95. Groundwater monitoring and landfill maintenance required.
Old Chlorine Plant WWTP	Presumptive remedy: Pond capped in 1978. Groundwater monitoring and cap maintenance required.
Old Brine Mud Pond	Presumptive remedy: Pond contents approved for delisting as a hazardous waste and pond capped in 1985. Groundwater monitoring and cap maintenance required.
Chlorine Plant North Check Pond	Presumptive remedy: Pond contents and liner removed. Confirmatory samples taken and pond backfilled in 1992.
New Carbon Tetrachloride WWTP	Presumptive remedy: Pond drained and soils tested. Pond backfilled in 1993.
LeMoyne LeCreek WWTP	Managed under EPA's Clean Water Act

further consideration. Only the Halby area was carried through for further analysis. The status of the remaining 13 source areas is summarized in Table 6-10.

## 7.0 DESCRIPTION OF ALTERNATIVES

EPA evaluated eight alternatives for the remediation of contaminated soil at OU#2 of the Site in the Supplemental Feasibility Study for the Halby Area and in the Proposed Plan for the Site, along with the No Action alternative. The site-specific alternatives analyzed in the Supplemental Feasibility Study represented a range of distinct waste-management strategies addressing the human health and environmental concerns. Eight remedial technologies for containment or treatment were analyzed. Although the selected remedial alternative will be further refined as necessary during the predesign phase, the analysis presented below reflects the fundamental components of the various alternatives considered feasible for this Site.

Time frames for achieving remediation goals were calculated for each of the alternatives. For the No Action alternative and Alternatives 1 and 7, assumptions were made regarding the mass of contamination in the soil and the movement of contamination through the soil. Because of the considerable variability and complex distribution of contaminants in the former Halby area, these assumptions have a great deal of uncertainty. Therefore, the actual time to achieve remediation for these alternatives may vary greatly. However, the relative time frames for these alternatives should remain the same, i.e. Alternative 7 with active soil flushing will achieve remediation goals sooner than the No Action alternative and Alternative 1.

### 7.1 ALTERNATIVE NO. 0 - NO ACTION

The no action alternative is carried through the screening process as required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This alternative is used as a baseline for comparison with other alternatives that are developed. Under this alternative, EPA would take no further action to minimize the impact soil contamination has on the groundwater. Contamination could continue to migrate from the Halby area into the groundwater. Groundwater cleanup would continue under OU1. Cleanup times of 13 to 26 years are estimated for this alternative. The O&M costs of on-going groundwater treatment is estimated to be \$517,000 for a 26 year period.

### 7.2 ALTERNATIVE NO. 1 - INSTITUTIONAL CONTROLS

Major components of this alternative would include legal restrictions to ensure no disturbance of existing remedial systems or site soils would occur. Under this alternative, EPA would monitor the impact soil contamination has on the groundwater. Groundwater cleanup and monitoring would continue under the OU1 remediation. Cleanup times of 13 to 26 years are estimated for this alternative. The cost of this alternative is estimated to be \$535,000. The costs include legal costs for deed restrictions and operations and maintenance (O&M) costs for groundwater treatment and monitoring.

### 7.3 ALTERNATIVE NO. 2 - MULTI-LAYER CAP

Major components of this alternative include site preparation and construction of a multi-layer cap composed of a clay layer, a synthetic membrane cap with heat sealed joints, a drainage layer, a cobblestone layer, and a cover material for vegetation. Groundwater monitoring would be conducted for a minimum of five years to determine if leaching from this area is reduced. O&M activities include cap maintenance, lawn care, groundwater treatment for one year, and routine inspections and reviews. This alternative is estimated to reduce the groundwater contaminant levels to below the performance standards within one year. The cost of this alternative is estimated to be \$884,000.

### 7.4 ALTERNATIVE NO. 3 - EXCAVATION AND OFFSITE DISPOSAL

This alternative would involve site preparation and excavation activities in the area. The excavated soil would be transported for disposal at a regulated landfill. After confirmation sampling documented that excavation was complete, the excavated area would be backfilled with clean soil fill and revegetated. Excavation beyond 30 feet below ground surface, if required, would require extensive shoring efforts. Groundwater monitoring would be conducted for a minimum of two years to verify that contaminant concentrations are below the OU1 cleanup goal. O&M costs include routine inspections and reviews. This alternative is estimated to meet soil and groundwater performance standards within one year. The cost of this alternative is estimated to be \$6,195,000.

### 7.5 ALTERNATIVE NO. 4 - EXCAVATION AND EX-SITU ONSITE BIOREMEDIATION

This alternative would involve a treatability study to determine the optimal bioremediation techniques. After construction of the bioremediation system, contaminated soil would be excavated and treated onsite. Confirmation sampling would verify that excavation was complete and that soils were clean, before the treated soil was backfilled into the excavation area. Groundwater monitoring would be conducted for a minimum of two years to verify that contaminant concentrations are below the OU1 cleanup goals. O&M costs include routine inspections and reviews. This alternative is estimated to meet soil and groundwater performance standards within one year. The cost of this alternative is estimated to be \$11,720,000.

### 7.6 ALTERNATIVE NO. 5 - EXCAVATION AND EX-SITU BIOREMEDIATION/IN-SITU SOIL FLUSHING

This alternative would involve a treatability study to determine the optimal bioremediation techniques and test to determine design parameters for the soil flushing system. The silty clay layer of soil would be excavated and treated by bioremediation. Because of safety concerns with deep excavation activities, the remaining soil would be treated by soil flushing to move contaminants into the groundwater for capture and treatment. Since the site already has

contaminated groundwater under OU1, in-situ soil flushing was considered a viable means for soil remediation. Sampling would be conducted to demonstrate the effectiveness of the bioremediation and soil flushing. Treated soil which was documented to be clean would be backfilled into the excavated area. Groundwater monitoring would be conducted for a minimum of two years to verify that contaminant concentrations are below the OU1 cleanup goals. O&M costs include routine inspections and reviews. This alternative is estimated to meet soil performance standards within five to ten years. The cost of this alternative is estimated to be \$5,409,000.

#### 7.7 ALTERNATIVE NO. 6 - EXCAVATION AND OFFSITE DISPOSAL/ IN-SITU FLUSHING

This alternative would involve tests to determine the design parameters for the soil flushing system. The silty clay layer of soil would be excavated and transported for disposal at a regulated landfill. The remaining soil would be treated by soil flushing to move contaminants into the groundwater for capture and treatment. Since the site already has contaminated groundwater under OU1, in-situ soil flushing was considered a viable means for soil remediation. Sampling would be conducted to demonstrate the effectiveness of the excavation and soil flushing. The excavated area would be backfilled with clean soil fill. Groundwater monitoring would be conducted for a minimum of two years to verify that contaminant concentrations are below the OU1 cleanup goals. O&M costs include routine inspections and reviews. This alternative is estimated to meet soil performance standards within six to twelve years. The cost of this alternative is estimated to be \$3,465,000.

#### 7.8 ALTERNATIVE NO. 7 - IN-SITU SOIL FLUSHING

This alternative involves flushing the affected soil with water to move the contamination into the groundwater and to accelerate the natural breakdown of contamination into non-toxic chemicals. Since the site already has contaminated groundwater under OU1, in-situ soil flushing was considered a viable means for soil remediation. Implementation of this remedy would involve tests to determine design parameters for the soil flushing system. The soil would be treated by soil flushing to move contaminants into the groundwater for capture and treatment. Groundwater monitoring would begin after construction of the remedy is complete and would be conducted for a period of time adequate to establish that the remedy is effective. O&M includes groundwater treatment and routine inspections and reviews. This alternative is estimated to meet soil performance standards within six to twelve years. The cost of this alternative is estimated to be \$501,000.

#### 7.9 ALTERNATIVE NO. 8 - ASPHALT CAP

This alternative is similar to Alternative 2, except the cap is less complex. Implementation of this alternative would involve site preparation, installation of a gravel base, and installation of an asphalt pavement. Groundwater monitoring would be conducted for a minimum of five years to

determine if leaching from this area is reduced. O&M activities include cap maintenance, lawn care, groundwater treatment for one year, and routine inspections and reviews. This alternative is estimated to reduce the groundwater contaminant levels to below the performance standards within one year. The cost of this alternative is estimated to be \$598,000.

## 8.0 SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the ROD provides the basis for determining which alternative provides the best balance with respect to the statutory balancing criteria in Section 121 of CERCLA and in 40 CFR Section 300.430 of the NCP. The major objective of the Supplemental FS was to develop, screen, and evaluate alternatives for the remediation of Operable Unit Two at the site. The remedial alternatives selected from the screening process were evaluated using the following nine evaluation criteria:

- Overall protection of human health and the environment.
- Compliance with applicable and/or relevant and appropriate Federal or State public health or environmental standards.
- Long-term effectiveness and permanence.
- Reduction of toxicity, mobility, or volume of hazardous substances or contaminants.
- Short-term effectiveness, or the impacts a remedy might have on the community, workers, or the environment during the course of implementing it.
- Implementability, that is, the administrative or technical capacity to carry out the alternative.
- Cost-effectiveness considering costs for construction, operation, and maintenance of the alternative over the life of the project.
- Acceptance by the State.
- Acceptance by the Community.

The NCP categorizes the nine criteria into three groups:

(1) Threshold Criteria - overall protection of human health and the environment and compliance with ARARs (or invoking a waiver) are threshold criteria that must be satisfied in order for an alternative to be eligible for selection;

(2) Primary Balancing Criteria- long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability, and cost are primary balancing factors used to weigh major trade-offs among alternative hazardous waste management strategies; and

(3) Modifying Criteria- state and community acceptance are modifying criteria that are formally taken into account after public comment is received on the proposed plan and incorporated in the ROD.

The selected alternative must meet the requirement for overall protection of human health and the environment and comply with all ARARs or be granted a waiver for compliance with ARARs. Any alternative that does not satisfy both of these requirements is not eligible for selection. The Primary Balancing Criteria are the technical criteria upon which the detailed analysis is primarily based. The final two criteria, known as Modifying Criteria, assess the public's and the state agency's acceptance of the alternative. Based on these final two criteria, EPA may modify aspects of a specific alternative.

The following analysis is a summary of the evaluation of alternatives for remediating the Stauffer LeMoyne OU2 Superfund Site under each of the criteria. A comparison is made between each of the alternatives for achievement of a specific criterion.

## **Threshold Criteria**

### **8.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT**

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced or controlled through treatment, engineering controls and institutional controls. The no-action alternative and alternative 1 would not involve any active remediation efforts. However, natural flushing would move contamination from the soil into the groundwater where it would be captured and treated by the OU1 system. Therefore, human health and the environment would be protected after approximately 13 to 26 years. Alternative 1 would provide an additional level of protection by using institutional controls to prevent disturbance of surface or subsurface soils which would interfere with the movement of contamination from the soil into the groundwater. Alternative 7 utilizes active soil flushing to remove contamination from the soil into the groundwater where it would be captured and treated by the OU1 system. Alternatives 2 and 8 would prevent contamination from migrating into the groundwater, but would require perpetual cap maintenance. Any breach in the cap would potentially allow contamination to migrate into the groundwater. The remaining alternatives provide adequate protection through proper disposal or treatment.

## 8.2 COMPLIANCE WITH ARARS

Section 121 (d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirement standards, criteria, and limitations which are collectively referred to as “ARARs,” unless such ARARs are waived under CERCLA Section 121(d)(4). Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial actions to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site. Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

No chemical specific ARARs exist for soil contamination. Chemical specific ARARs for groundwater are found in the Safe Drinking Water Act (40 CFR 141) in the form of Maximum Contaminant Levels (MCLs) for public water systems. All remedies would be implemented to ultimately reduce migration of contaminants from subsurface soil, so that MCLs would be met.

Location-specific ARARs address remedial activities in specific sensitive locations. Some areas of contamination at the site involve wetlands or 100-year floodplains. Operable Unit 2 of the Site is not within an area affecting national wildlife, scenic, or recreational areas or within environmental significant agricultural areas. Neither is the site a critical habitat area or on property which is included on the National Register of Historic Places. No location-specific ARARs were identified for OU2 of the Site.

Action-specific ARARs are usually technology or activity based requirements or limitations on actions taken with respect to hazardous substances. All alternatives would be implemented to comply with action-specific ARARs. All excavation, storage, handling, treatment and disposal of contaminated soil would be conducted in accordance with applicable or relevant and appropriate RCRA requirements. Off-site disposal of contaminated soil under Alternatives 3 or 6 would be at a permitted RCRA Subtitle C, or Subtitle D landfill, as appropriate. During treatment, air emissions from the site would be monitored to ensure compliance with the Clean Air Act. Air monitoring would be conducted to ensure that contaminant concentrations do not exceed levels considered to be safe for human health. If levels are exceeded, mitigative procedures would be employed to prevent harmful levels of air emissions from impacting on-site workers or from leaving the Site. EPA developed soil performance standards for cyanide and thiocyanate, since chemical-specific ARARs did not exist. Alternatives 2 and 8 would not comply with the soil performance standards which were developed. However, implementation of alternative 2 or 8

would result in OU1 performance standards for groundwater being achieved. The remaining alternatives would be implemented to comply with the soil performance standards.

## **Primary Balancing Criteria**

### **8.3 LONG-TERM EFFECTIVENESS AND PERMANENCE**

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Alternatives 2 and 8 would not remove contaminated soil from the Halby area. However, the cap would be effective in protecting groundwater by reducing migration of contamination into the groundwater. The cap would require yearly maintenance to ensure protection of groundwater. Alternatives 3 and 4 would provide long-term effectiveness and permanence by removing or treating the entire source area. Alternatives 5 and 6 would provide long-term effectiveness and permanence by removing or treating a portion of the source and by flushing remaining contamination into the groundwater for capture and treatment. Alternative 0, 1 and 7 would provide long-term effectiveness and permanence by flushing contamination into the groundwater for capture and treatment.

### **8.4 REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT**

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of the remedy. Although Alternatives 2 and 8 would not reduce toxicity, mobility, or volume through treatment, they would reduce mobility of the contaminants through the soil, if the cap is properly installed and maintained. Over time, contaminant levels in the existing areas of contamination may decrease through natural attenuation. Alternative 3 and the landfill portion of Alternative 6 also would not reduce toxicity, mobility, or volume through treatment. However, placement of the soil in a permitted landfill would reduce mobility of the contaminants. Alternatives 4 and 5 would reduce toxicity, mobility, and volume through treatment of all or some of the contaminated soil. Flushing contaminants into the groundwater in Alternatives 0,1,5,6 and 7 would reduce toxicity and volume, when contaminants are captured and treated by the groundwater remedy system.

### **8.5 SHORT-TERM EFFECTIVENESS**

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until clean-up goals are achieved. For all alternatives involving construction, impacts such as noise, dust, and odors can be controlled with standard procedures. There would be potential risk to workers during excavation and treatment of soils and

construction of the cap, primarily associated with equipment movement and exposure to contaminated dust. Air monitoring, on-site and at the site boundary, and engineering controls would control the potential for exposure. Workers would be required to wear appropriate levels of protection to avoid exposure during excavation and treatment. For Alternatives 4 and 5 treatability studies would be conducted to determine how to prevent undesirable reactions during treatment.

Alternatives 0 and 1 require the longest time frames to meet soil and groundwater cleanup standards. Of the alternatives involving active remediation, Alternatives 4 and 5 would require longer time frames for construction and implementation. Of the active remediation alternatives, Alternatives 5,6 and 7 would require longer time frames for meeting soil and groundwater cleanup standards.

## 8.6 IMPLEMENTABILITY

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

Alternatives 0 and 1 are most easily implemented, since no active remediation is involved. Alternatives 2,3 and 8 are easily implemented using readily available materials, equipment, and labor. Alternative 4 involves a technology for which engineering services are available. The technology has proven effective in the past. This alternative would require treatability studies to resolve operational issues. Alternative 5 involves two technologies for which services, equipment, and labor are available. Treatability studies for bioremediation would be necessary. Services, equipment and labor to implement Alternatives 6 and 7 are available. For Alternatives 3 through 6, excavation beyond 30 feet below ground surface, if require, would require extensive shoring methods, which are available.

## 8.7 COST

The non-active remediation alternatives are the most cost effective alternatives. Of the active remediation alternatives, the treatment remedies are most costly than capping and off-site disposal alternatives. However, the treatment remedies provide more permanence and meet the regulatory preference to reduce toxicity, mobility, and volume through treatment. Of the treatment alternatives, bioremediation would be the most costly, due to the need for treatability studies and the increased labor requirements to construct and operate the system.

## **Modifying Criteria**

### **8.8     STATE ACCEPTANCE**

The State of Alabama, as represented by the Alabama Department of Environmental Management (ADEM), has been the support agency during the Remedial Investigation and Feasibility Study process for the Stauffer LeMoyne OU2 site. In accordance with 40 CFR 300.430, as the support agency, ADEM has provided input during this process. The State of Alabama, as represented by ADEM, has concurred with the selected remedy.

### **8.9     COMMUNITY ACCEPTANCE**

Comments were received on the proposed plan for Operable Unit 2 of the Site. The comments and their responses are summarized in the responsiveness summary in Attachment 2.

### **9.0     SUMMARY OF SELECTED REMEDY**

Based upon consideration of the requirements of CERCLA, the NCP, the detailed analysis of alternatives and public and state comments, EPA has selected a remedy for Operable Unit 2 of the Site. The selected remedy is Alternative 7, In-situ Soil Flushing. This remedy is selected because it provides cleanup of contaminated subsurface soil within six to twelve years, but has the lowest cost of the alternatives.

### **9.1     SOIL REMEDY**

Approximately 39,700 cubic yards of subsurface soil containing thiocyanate and cyanide above the performance standards are present in the Halby Area. Previous data indicate that natural soil flushing is moving subsurface soil contamination from the soil into the groundwater where it is being captured by the existing groundwater pump-and-treat system. The selected remedy for contaminated soils accelerates this natural process with an in-situ soil flushing system. This remedy provides for the following:

- Institutional controls to restrict the Site from being used as residential property and to restrict any construction on the former Halby area which would interfere with the construction and operation and maintenance of the selected remedy,
- Construction of a soil flushing system to accelerate the migration of contaminants from the subsurface soil into the groundwater where it will be captured and treated by the existing OU1 groundwater remedy,

- Monitoring of subsurface soil for cyanide and thiocyanate on an annual basis to determine if contaminants are moving into the groundwater in a controlled manner where they will be captured and treated by the OU1 groundwater remedy, and
- Periodic reporting of annual monitoring results to EPA.

Because a risk assessment for a future residential scenario was not performed for OU2 of the Site, institutional controls restricting the Site from use as residential property must remain in place until a human health risk assessment is conducted which demonstrates to EPA that the Site does not pose any unacceptable risks to future residents. The institutional controls restricting any construction on the former Halby area which would interfere with the operation and maintenance of the selected remedy can be removed when EPA determines that the subsurface soil monitoring demonstrates that the performance standards have been met.

This remedy is contingent upon the continued operations and maintenance of the Operable Unit 1 groundwater pump and treatment system. Accordingly, if the groundwater pump and treatment system is not operated and maintained for the life of this remedy for OU2, EPA may, at its sole discretion, select an alternative remedy for OU2. Similarly, if, at any time, the selected remedy for OU2 is found to be ineffective at reducing subsurface soil contaminant concentrations, EPA may, at its sole discretion, select an alternative remedy for OU2.

<b>TABLE 9-1 - SUBSURFACE SOIL PERFORMANCE STANDARDS</b>		
<b>Contaminant</b>	<b>Performance Standard</b>	<b>Basis for Performance Standard</b>
Cyanide	0.47 mg/kg (ppm)	Compliance with MCLs
Thiocyanate	8.5 mg/kg (ppm)	Risk assessment (HQ=1)

MCL - Maximum Contaminant Level (EPA Safe Drinking Water Act)

ppm - parts per million

HQ - Hazard quotient

In order to facilitate this remedy, the former Halby area, which includes the location of the former Halby facility, including the Halby Treatment Pond, located in the northwest portion of the Stauffer LeMoyne site, is designated as an Area of Contamination (AOC) for purposes of this ROD. All waste managed within the AOC must comply with the requirements set out in this ROD for soil remediation. The AOC also includes suitable areas in close proximity to the contamination necessary for implementation of the remedy selected in this ROD.

## 9.2 PERFORMANCE STANDARDS FOR SOIL

Subsurface soil performance standards were developed for the protection of groundwater. Remediation of subsurface soils to these performance standards will reduce migration of contamination to groundwater, so flat groundwater will not pose an unacceptable risk to potential users of groundwater as a drinking water source. The subsurface soil performance standards are presented in Table 9-1.

## 9.3 CONFIRMATION TESTING

Soil testing shall be conducted on the site to determine the effectiveness of meeting the soil performance standards outlined in Table 9-1. This sampling will be conducted in accordance with an EPA approved sampling and analysis plan. Performance standards will be met only when the confirmatory sampling shows to EPA that subsurface soil samples have been remediated to a level at or below the performance standards. Subsurface soil sampling and analysis shall be conducted no less frequently than every 12 months.

Confirmation testing may also require the installation and monitoring of additional piezometers. The purpose of the piezometers is to verify groundwater capture from beneath the former Halby area, as predicted in groundwater models. The piezometers shall be monitored on an annual basis. The piezometers will be required if EPA determines that existing monitoring wells do not adequately confirm the capture of the contaminants. If data from the piezometers and other monitoring wells indicate that groundwater capture from beneath the former Halby area is not occurring as predicted in groundwater models, EPA may, at its sole discretion, select an alternative remedy for OU2.

## 9.4 COST

For in-situ soil flushing, the estimated present worth cost of the remedy is approximately \$501,000. These costs include fees for institutional controls, as well as operations and maintenance costs. These estimated costs include \$197,000 in capital costs and \$304,000 in operation and maintenance costs, including a 20% contingency.

## 9.5 EXPECTED OUTCOME OF THE SELECTED REMEDY

The selected remedy addresses contaminated subsurface soil which is continuing to contaminate underlying groundwater. The remedy will maintain the current land use of the Site, which is industrial use. The contamination from the Halby area is expected to attenuate to acceptable levels (below the performance standards) within six to twelve years.

<b>TABLE 9-2 - SUMMARY OF SELECTED REMEDY COSTS</b>				
<b>Capital Costs</b>	Quantity	Unit	Unit Cost	Estimated Installed Cost
Site preparation	1	LS	\$57,200	\$57,200
Soil flushing components	1	LS	\$41,100	\$41,100
Direct Construction Cost (DCT)				\$98,300
Indirect Construction Cost (15% of DCT)				\$15,000
Construction Total (CT)				\$113,000
Permitting and Legal				\$40,000
Design/Resident Engineering (10% of CT)				\$11,000
Total Capital Costs				\$164,000
Contingency (20%)				\$33,000
<b>O&amp;M Costs</b>				
Site Inspections	96	Hour	\$70	\$6,700
Repair/Maintenance	2	LS	\$1,200	\$2,400
Biennial Groundwater Monitoring (Annualized)	1	LS	\$3,200	\$3,200
Recovered Water Treatment	1	LS	\$25,000	\$25,000
5-Year Review of Effectiveness (Annualized)	1	LS	\$1,800	\$1,800
Total Annual O&M Cost				\$39,100
8 Year Present Worth Cost				\$253,000
Projected O&M Cost*				\$304,000
<b>TOTAL COST</b>				<b>\$501,000</b>

\* Projected O&M cost includes 20% contingency

LS - Lump sum

Notes:

- 1) Estimated costs are based on conceptual evaluation of the potential remedy and are subject to change based on preliminary and final design
- 2) Unit costs were obtained from Means Building Construction Cost Data 1995, as well as professional experience

## 10.0 STATUTORY DETERMINATION

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that achieve adequate protection of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences. These specify that, when complete, the selected remedial action for this Site must comply with applicable or relevant and appropriate environmental standards established under Federal and State environmental laws. The selected remedy also must be cost-effective and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. Finally, the statute includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

### 10.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The selected remedy protects human health and the environment through monitoring the isolation and treatment of threats at Operable Unit 2 of the Site in the contaminated subsurface soil. The selected remedy provides protection of human health and the environment by reducing and controlling risk through movement of contamination from the subsurface soils to the groundwater and treatment of groundwater (through the existing OU1 remedy). Contamination in the subsurface soils at Operable Unit 2 of the Site will be moved by in-situ soil flushing into the groundwater, where contaminants will be captured and treated. The subsurface soils will be cleaned up to levels that are protective of groundwater.

### 10.2 ATTAINMENT OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Remedial actions performed under CERCLA must comply with all applicable or relevant and appropriate requirements (ARARs). All alternatives considered for OU2 of the Site were evaluated on the basis of the degree to which they complied with these requirements. The selected remedy was found to meet or exceed all ARARs, which are listed in Table 10-1.

#### Waivers

Section 121 (d)(4)(C) of CERCLA provides that an ARAR may be waived when compliance with an ARAR is technically impracticable from an engineering perspective. No waivers are necessary with respect to the selected remedy.

## **Other Guidance To Be Considered**

Other Guidance To Be Considered (TBCs) include health based advisories and guidance. TBCs have been utilized in estimating incremental cancer and non-cancer risk numbers for the site. The risk numbers are evaluated relative to the normally accepted point of departure risk range of  $10^{-4}$  to  $10^{-6}$  or a hazard quotient of 1.

### **10.3 COST EFFECTIVENESS**

Cost effectiveness is determined by comparing the cost of all alternatives being considered with their overall effectiveness to determine whether the costs are proportional to the effectiveness achieved. Overall effectiveness is defined by three of the five balancing criteria: long-term effectiveness, short-term effectiveness, and reduction of toxicity, mobility, or volume through treatment. EPA evaluates the incremental cost of each alternative as compared to the increased effectiveness of the remedy. The selected remedy provides long-term effectiveness and reduction of toxicity, mobility, or volume through treatment. Other alternatives provide greater short-term effectiveness, in shorter time frames, for completion. However, the costs of these alternatives are much greater. Given that groundwater is not currently used as a drinking water source and is not anticipated to be used in the next 30 years, the selected remedy is the most cost-effective. EPA chose a remedy which accelerates soil remediation over natural flushing because the remedy is more cost effective. In addition, uncertainties in calculating remediation times make it prudent to select a remedy which has greater short term effectiveness when practicable.

The estimated cost of EPA's selected remedy is \$501,000. The selected remedy, Alternative 7, is the least costly alternative.

### **10.4 UTILIZATION OF PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE**

The selected remedy utilizes permanent solutions to the maximum extent practicable by using treatment to permanently reduce contaminant levels. This remedy provides long-term protectiveness by accelerating and monitoring the migration of contaminants from subsurface soils into the groundwater where it will continue to be captured and treated by the OU1 remedy. Reduction of toxicity, mobility, or volume through treatment is provided by removing contaminants from the subsurface soil by flushing contaminants into the groundwater. Contaminants will be captured and removed from the groundwater by the OU1 remedy. Alternative 1, Institutional Controls, would provide the same protection, but over a much longer time period. The capping alternatives, Alternatives 2 and 8, are not as effective in providing long-term effectiveness, since contamination will remain in the subsurface soil. In addition, these remedies do not provide reduction of toxicity, mobility, or volume through treatment. Alternative 3, excavation and off-site disposal, provides long-term effectiveness but does not reduce toxicity,

mobility, or volume through treatment. The excavation and treatment alternatives, Alternatives 4, 5, and 6, provide long-term effectiveness, and reduction of toxicity, mobility, or volume through treatment. However, these alternatives are not cost effective. Cost and long-term effectiveness were the most decisive criteria in the selection decision.

#### 10.5 PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

The statutory preference for treatment will be met because the selected remedy treats subsurface soil contamination by flushing contamination into the groundwater where contamination will be captured and treated under the Operable Unit 1 remedy.

#### 10.6 FIVE-YEAR REVIEW REQUIREMENTS

This remedy is based on risk assessments for industrial use scenarios. Contamination may be present which would restrict the use of this property for residential use. Because this remedy may result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

#### 11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The subsurface soil performance standard for cyanide was changed from 0.64 mg/kg to 0.47 mg/kg. The 0.64 mg/kg proposed standard in the proposed plan was a typographical error. In addition, the cost estimate for each alternative was re-evaluated due to the age of some of the estimates. Estimates for all alternatives were modified based on more recent and accurate cost data. The cost of each alternative changed following release of the proposed plan. The most significant cost update was in the cost of treating contaminated groundwater from the active soil flushing alternative (Alternative 7). This change resulted in the total cost for Alternative 7 changing from \$3,939,300 to \$501,000. The no-action alternative (Alternative 0) and the institutional controls alternative (Alternative 1) also changed significantly due to the addition of groundwater treatment costs to the cost estimates. EPA understands that the revisions occurred due to the use of more accurate cost measurements, in place of the assumptions previously used by the parties that prepared the RI/FS. Both sets of data are available for review and comparison in the Administrative Record.

**TABLE 10-1 APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS**

<b>ACTION-SPECIFIC ARARS</b>			
<b>Standard, Requirement, Criteria, or Limitation</b>	<b>Citation</b>	<b>Applicable or Relevant &amp; Appropriate</b>	<b>Description</b>
<b>Federal</b>			
<b>Occupational Safety and Health Act</b>	20 USC Section 651-678	Applicable	Regulates worker health and safety.
<b>Clean Water Act</b>	40 CFR 122.28	Relevant and appropriate	Establishes standards under the National Pollutant Discharge Elimination System (NPDES) for discharges to surface waters
<b>Clean Air Act</b>	42 USC Section 7401-7642	Applicable	
National Ambient Air Quality Standards (NAAQS)	40 CFR Part 50	Applicable	Treatment technology standard for emissions to air Incinerators Surface impoundments Waste piles Landfills Fugitive emissions
<b>Resource Conservation and Recovery Act</b>	42 USC Section 6901-6907		
Characteristics of Hazardous Waste	40 CFR 261.24	Applicable	Describes methods for determining hazardous waste characteristics

<b>ACTION-SPECIFIC ARARS</b>			
<b>Standard, Requirement, Criteria, or Limitation</b>	<b>Citation</b>	<b>Applicable or Relevant &amp; Appropriate</b>	<b>Description</b>
Releases from Hazardous Waste Management Units	40 CFR 264.90 - 264.101	Relevant & appropriate	Monitor and respond to releases to uppermost aquifer beneath SWMU
Post-closure notices	40 CFR 264.119	Relevant & appropriate	Requires post-closure notices for hazardous waste disposal units
<b>State</b>			
NAAQS Particulate Matter	ADEM Section R.335-3-1.03	Applicable	Regulates fugitive particulate emissions
Underground Injection Control	ADEM Section R.335-6-8	Relevant and appropriate	Regulates soil flushing
Groundwater Protection	ADEM Section R.335-6-10	Applicable	Regulates soil flushing
Land Division Solid Waste Program Procedures	ADEM Section R.335-13-4 and R.335-13-5	Applicable	Procedures for obtaining disposal permits
<b>CHEMICAL-SPECIFIC ARARS</b>			
<b>Standard, Requirement, Criteria, or Limitation</b>	<b>Citation</b>	<b>Applicable or Relevant &amp; Appropriate</b>	<b>Description</b>
<b>Federal</b>			
Safe Drinking Water Act	40 CFR 141	Relevant and Appropriate	Establishes primary drinking water regulations and related regulations applicable to public water systems.

APPENDIX 1

RESPONSIVENESS SUMMARY

STAUFFER CHEMICAL CO. (LEMOYNE PLANT) SITE

OPERABLE UNIT 2

Responsiveness Summary  
Record of Decision  
Stauffer LeMoyne Site  
Operable Unit Two  
Axis, Mobile County, Alabama

The U.S. Environmental Protection Agency (EPA) held a public comment period from July 31, 1998 to August 31, 1998 for interested parties to give input on EPA's Proposed Plan for Remedial Action at Operable Unit Two (OU 2) of the Stauffer LeMoyne (Stauffer) Superfund Site in Axis, Mobile County, Alabama. EPA offered the opportunity for a public meeting; however, a public meeting was not requested. The public comment period was extended an additional 30 days, from August 31, 1998 to September 30, 1998, after EPA received a request for an extension.

A responsiveness summary is required to document how EPA addressed citizen comments and concerns about the Site, as raised during the public comment period. All comments summarized in this document have been factored into the amended final decision of the remedial action for OU 1 of the Stauffer Site.

This responsiveness summary for the Stauffer Site is divided into the following sections.

- I. Overview - This section discusses the recommended alternative for remedial action and the public reaction to this alternative.
- II. Background on Community Involvement and Concerns - This section provides a brief history of community interest and concerns regarding the Stauffer Site.
- III. Summary of Major Questions and Comments Received During the 1996 Public Comment Period and EPA's Responses - This section presents comments submitted during the public comment period and provides the responses to these comments.
- IV. Summary of Major Questions and Comments Received During the 1998 Public Comment Period and EPA's Responses.
- V. Concerns to be Addressed in the Future- This section discusses community concerns of which EPA should be aware during remedial design.

I. Overview

The remedial alternatives for the Stauffer site were presented to the public in an Proposed Plan released on July 31, 1998. The public comment period was July 31, 1998 through September 30, 1998. A public notice was published in the Mobile Register on July 31, 1998. The public notice indicated the EPA would hold a public meeting if requested by the public. Notice of the extension

to the public comment period was published in the Mobile Register on September 3, 1998. A public meeting was not requested by the public.

EPA has organized the work at this Site into three phases or operable units (OUs). OU1 involves the groundwater beneath the Stauffer LeMoyne site, as well as the Stauffer Cold Creek site. Current remedial actions on OU1 are addressing groundwater contamination underneath both Sites. Operable unit three addresses the swamp area located adjacent to the Stauffer LeMoyne and Stauffer Cold Creek Sites. This responsiveness summary addresses comments on operable unit two, which involves source contamination at the Stauffer LeMoyne Site. The contaminated area requiring remediation is limited to the former Halby area of the Site.

For the contaminated soils at OU2, the selected remedy is Alternative 7: In-situ Soil Flushing. The estimated cost of this alternative is \$501,000. This remedy accelerates natural processes which are moving contamination from the subsurface soil into the groundwater where it will be captured and treated. Institutional controls will restrict use of the Site for residential use and will limit the use of surface and subsurface soils in the former Halby area of the Site until the subsurface soil performance standards are met. Regular monitoring of subsurface soil will be conducted to determine if performance standards have been met. In addition, groundwater monitoring piezometers will be installed to confirm groundwater modeling.

This selected remedy differs from the proposed plan recommended remedy in that deed restrictions to prevent residential use of the property were added to the remedy.

## II. Background on Community Involvement and Concerns

EPA has taken the following actions to ensure that interested parties have been kept informed and given an opportunity to provide input on activities at the Stauffer OU2 Site.

Multiple meetings have been held regarding site work at the Stauffer LeMoyne site. The Satsuma Branch Library in Satsuma, Alabama was chosen as the local information repository for the Site. Fact sheets describing remedial investigations at the Site were issued in 1986 and 1989. A public comment period for operable unit one ran from July 13, 1989 to August 13, 1989. A public meeting was held on July 27, 1989. For operable unit three, availability sessions were held in February 1991 and April 1992. The public comment period ran from June 15, 1993 to July 14, 1993. A public meeting was held on June 29, 1993.

The public comment period on the proposed plan for the operable unit two ROD was July 31, 1998 through September 30, 1998. EPA published notice that it would hold a public meeting upon request of the community. However, a public meeting was not requested by the public. The administrative record was available to the public at both the information repository maintained at the Satsuma Branch Library and at the EPA Region IV Library at 61 Forsyth Street in Atlanta, Georgia. The notice of availability of the proposed plan and administrative record were published in the Mobile Register on July 31, 1998. Notice of the extension of the comment period was

published in the Mobile Register on September 3, 1998.

III. Summary of Major Questions and Comments Received During the Public Comment Period and EPA's Responses

1. Comment: Several commenters supported the proposed remedy.

EPA Response: EPA concurs.

2. Comment: Several commenters stated that they preferred the alternative of excavating contaminated soil and disposing the soil in an off-site landfill.

EPA Response: The excavation and off-site disposal alternative does not result in treatment of contamination to reduce toxicity, mobility, or volume of contamination. The selected alternative will move contamination into the groundwater, where the existing pump and treat system will capture and treat the contamination. In addition, the cost for the excavation and off-site disposal alternative is not justified given the current site conditions (e.g., no current unacceptable risk to workers, additional groundwater contamination which restricts groundwater use).

3. Comment: One commenter expressed concern that contamination may be migrating off-site into residential property. The commenter asked if the remedy would guarantee the elimination of future problems.

EPA Response: Monitoring data from OU1 wells indicates that contamination has not migrated into residential property. The selected remedy is intended to be a permanent solution for contaminated areas in operable unit two of the Site. Contamination from the soils will continue to be flushed into the groundwater, where the existing pump and treat system captures and treats the contamination. EPA will periodically inspect the groundwater system to ensure that it is operating effectively.

4. Comment: One commenter stated that the proposed plan incorrectly lists cyanide as a contaminant of concern. The commenter discussed previous soil sampling which suggested that the total cyanide detections were false positives arising from conversion of thiocyanate to cyanide during analysis.

EPA Response : EPA reviewed the report submitted by the commenter entitled "Stauffer LeMoyne Superfund Site, Former Halby Area Soil and Groundwater 1998 Sampling Results," dated July 6, 1998. The report does not unquestionably support the contention that the cyanide detected in the soil samples is an artifact of the analytical process. While the data produced by this effort may ultimately support the theory of interferences, the report is inconclusive with respect to the occurrence of false positive cyanide values. Therefore, cyanide will be retained as a contaminant of concern.

5. Comment: One commenter stated that the risk assessment in the proposed plan is premised on an inaccurate future use scenario for groundwater. The commenter pointed out that the groundwater is not currently used as a source of drinking water, that the groundwater underlying the Site is classified as Class II and so is not anticipated to be used as a drinking water source, that a public drinking water source is available in the area which has sufficient capacity for projected future use, and that there is no reasonably anticipated future use of groundwater at this industrial site which could result in human exposure risks, because the duration of the site-wide groundwater cleanup is estimated at approximately 30 years.

EPA Response: Although the groundwater beneath the Site is not currently used as a drinking water source, it has been used as a drinking water source in the past and is classified as Class II groundwater. According to EPA's "Guidelines for Ground-Water Classification under the EPA Ground-Water Protection Strategy," Class II groundwater includes groundwater which is currently used, or potentially available, for drinking water and other beneficial use. Future use is not limited to a 30 year time frame. Remediation of this groundwater aquifer will ensure the long-term availability of adequate water supplies. The decision to protect this aquifer is valid.

6. Comment: One commenter stated that the proposed plan mistakenly estimates the duration of groundwater remediation as five years. The feasibility study indicated that a period of 5 - 10 years would be required for the in-situ flushing system.

EPA Response: EPA agrees. The omission of the 5 - 10 year time range was an error. Based on new data, the time frame has been changed to six to twelve years.

7. Comment: One commenter stated that the recommended remedy is not consistent with the NCP. The proposed plan describes the selected remedy as being equal to the Institutional Controls alternative in all aspects except cost and short-term effectiveness. The commenter stated that no basis exists for accelerating the soil cleanup in the Halby area, since site-wide groundwater cleanup will not occur for an estimated 30 years. The commenter further states that an accelerated remedy is unjustified, since the groundwater beneath the Site is not currently, nor in the near-term, anticipated to be a source of drinking water.

EPA Response: Based on new cost data, the selected remedy is the least costly alternative. In addition, it results in cleanup of contaminated subsurface soils in significantly less time than the Institutional Controls alternative.

The recommendation of an active soil flushing alternative was partly based on Akzo Nobel's desire to have unrestricted use of the Halby area property. Akzo Nobel has indicated that its only current plan for the Halby area is for a railroad spur. A railroad spur could possibly be constructed so that it would not interfere with the selected remedy.

To EPA's knowledge, a 30 year time frame for groundwater remediation at the Site is undocumented in the Site files. The Record of Decision (ROD) statement that groundwater well monitoring will continue for 30 years was based on a RCRA requirement to monitor closed RCRA facilities for 30 years. However, the ROD does not provide a time frame for the groundwater cleanup. The 1992 preliminary remedial design report included groundwater modeling which demonstrated that 1 to 2 years would be required to capture groundwater from the contaminated areas. However, the report does not predict the time frame for reducing groundwater contamination to acceptable levels. The recommendation of an active soil flushing alternative is based on EPA's desire to accelerate subsurface soil clean up, since the potential exists for the groundwater to be cleaned in a shorter period of time than 30 years.

8. Comment: One commenter stated that EPA should be flexible in designing the soil remediation.

EPA Response: In meetings with potentially responsible parties, EPA has indicated its willingness to be flexible in the design of the soil remediation.

APPENDIX 2

STATE CONCURRENCE LETTER

STAUFFER CHEMICAL CO. (LEMOYNE PLANT) SITE

OPERABLE UNIT 2

MAR-18-99 THU 10:47

LAND

FAX NO. 1 334 279 3050

P. 02

5 9 0059

**ADEM**



**ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT**

POST OFFICE BOX 301463 • 1761 OCHIL W. L. DICKSON DRIVE 36109-3808  
MONTGOMERY, ALABAMA 36130-1463

JAMES W. WARD  
DIRECTOR

WWW.ADEM.STATE.AL.US  
(334) 271-7700

DON SIEGELMAN  
GOVERNOR

March 18, 1999

Ms. Annie M. Godfrey  
Remedial Project Manager  
South Site Management Branch  
U.S. Environmental Protection Agency  
Region 4  
Atlanta Federal Center  
61 Forsyth Street, SW  
Atlanta, GA 30303-3104

Facilities: (334)  
Administration: 271-7650  
Air: 279-3044  
Land: 279-3050  
Water: 279-3051  
Groundwater: 279-5831  
Field Operations: 279-6131  
Laboratory: 277-6718  
Education/Outreach: 213-4998

Re: Draft Record of Decision  
Stauffer LeMoyne Site, Operable Unit 2  
Axis, Alabama

Dear Ms. Godfrey:

The Alabama Department of Environmental Management (ADEM) has reviewed the referenced Draft Record of Decision. Based on our review, we concur with the Draft Record of Decision.

If there are questions regarding this matter, please contact Mr. Keith West of the Industrial Facilities Section at (334) 271-7754.

Sincerely,

  
Wm. Gerald Hardy, Chief  
Land Division

WGH/KNW/sem:L: Akzo OU-2 Draft ROD (3-18-99)

File: Akzo/CERCLA/Rod Correspondence

Birmingham  
110 Vulcan Road  
Birmingham, Alabama 35203-4760  
(205) 942-6168  
(205) 941-1800 (Fax)

Dothan  
2788 69 Avenue, SE, Suite B  
Dothan, Alabama 36826-1328  
(205) 883-1713  
(205) 340-0889 (Fax)

Mobile  
8284 Perimeter Road  
Mobile, Alabama 36615-1131  
(256) 460-8400  
(256) 478-2368 (Fax)

Mobile - Coastal  
4171 Cummings Drive  
Mobile, Alabama 36615-1421  
(256) 432-0639  
(256) 432-6686 (Fax)



Printed on Recycled Paper